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NON-MALIGNANT TUMORS OF THE DUODENUM

REPORT OF TWO CASES*

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BENIGN tumors of the duodenum are seldom encountered, if one may judge by the few reports in the literature. They appear to be more uncommon than similar growths in the stomach and large intestine. For many years benign tumors of the duodenum were discovered only incidentally at necropsy and the reports were made by pathologists. More recently evidences of these growths have been demonstrated upon roentgen examination of the gastrointestinal tract and they have been removed at operation.

LITERATURE

The earliest definite reference to nonmalignant tumors of the duodenum which I have been able to find was by von Rokitanski[16] in his "Lehrbuch der pathologischen Anatomie" published in 1861. In discussing connective tissue tumors of the intestine, he mentions the possibility of their causing intussusception, and remarks that in the duodenum they may press upon the bile and pancreatic ducts causing a retention of their contents. He gives no specific case reports.

Smoler[11] refers to a case recorded by Cruveilhier,[3] observed in 1835, as an adenoma of the duodenum. This is a beautifully clear and accurate clinical record with necropsy findings accompanied by two remarkable drawings. A woman, aged twenty-nine, died with symptoms of intestinal obstruction. Necropsy disclosed an intussusception high in the small intestine with two sessile "mammillated" tumors, the larger about the size of a walnut. The drawing shows two typical polyps. The exact anatomical relations were not definite, however, and it seems to me highly probable that they arose distal rather than proximal to the duodenojejunal junction.

Steiner[12] mentions a case of calcified submucosal fibromyoma of the "pars transversus duodeni" about the size of a cherry stone which was described in 1864 by Virchow.[15]

Salvioli,[10] in 1876, reported an adenoma of the duodenum, the exact location not mentioned. The tumor was 2.2 cm. in diameter and was composed of Brunner's glands. The writer stated that he had been unable to find a previous record of an adenoma of Brunner's glands in the literature.

In 1883, Wesener[19] reported a myoma the size of a fist arising in the left side of the wall of the descending limb of the duodenum at the level of the papilla of Vater. The patient was a man fifty-five years of age who had constipation with attacks of diarrhea and severe vomiting,

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finally dying of inanition. The greater part of the tumor mass lay outside the duodenum and pressed upon the pancreas. The portion projecting into the gut was ulcerated. This writer includes another instance of myoma of the duodenum located on the posterior wall about 5 cm. above the papilla of Vater. The tumor was 4 cm. in diameter, and projected more into the peritoneal cavity than into the duodenum. It was adherent to the common duct and the pancreas.

Perry,[9] in 1893, described the case of a woman, aged forty-nine, who had jaundice for three months with fever and intestinal bleeding. At necropsy a cauliflower-like tumor, $1\frac{1}{2} \times \frac{3}{4} \times \frac{1}{2}$ in., overlay the papilla in the duodenum. A microscopic examination is not mentioned, but the description of the tumor suggests that it was an adenoma composed of mucous glands, a mucous polyp.

Hauser,[7] in 1895, reported the case of a markedly emaciated thirty-three year old man who complained of severe diarrhea with bloody mucus of eleven weeks' duration and of pain in the lower part of the abdomen. Polypoid masses and evidence of an ulcerated carcinoma were found in the rectum. At necropsy many polyps of adenomatous structure and varying in size from a pin-head to a hazelnut were found in the rectum, sigmoid, transverse, ascending colon and cecum. In the duodenum were numerous warty thickenings on the edges of the mucosal folds and small pedunculated polyps. At the junction of the descending with the horizontal portion was a pedunculated growth about the size of a walnut, slightly ulcerated in its center. Flat warty mucosal thickenings were found in the pyloric end of the stomach.

In 1897 Thompson[13] showed a specimen of polypoid growth in the duodenum to the Pathological Society of Manchester. The tumor was about the size of a walnut, attached to the region of the pylorus and possessed a well-marked pedicle from which it hung freely in the interior of the gut. Continuous with the pedicle was a mass of hypertrophied mucous membrane which microscopic examination showed to be partly gastric and partly duodenal in character. The gastric portion extended through the pylorus into the stomach where it was continuous with the general lining mucosa and this mass almost entirely occluded the passage. It was found that a very small stream of water could pass from the stomach onwards. There was also a small intussusception of the pyloric end of the stomach into the duodenum. The specimen was obtained from a dissecting room subject, aged seventy-five years, and the clinical history available indicated that the tumor gave rise to no symptoms during life. Microscopically the polypus was found to be fibroadenomatous in nature.

Funkenstein,[6] in 1904, described the case of a twenty-four year old woman whose illness began two years previously with pain in the upper abdomen and vomiting several hours after eating, and persistent diarrhea, occasionally with blood. Later fever, swelling of the feet and ankles and marked anemia appeared. At necropsy three polyps, from the size of a pea to that of a bean, were found in the stomach, six in the duodenum and a large number throughout the entire large intestine. The histological examination showed them to be adenomata composed of mucous cells.

In 1907 Doering[4] reported the case of a man, aged twenty-eight, with a history of bloody bowel movements seven years before admission, followed by six years of comparative freedom from symptoms. Shortly before admission the diarrhea recurred, with emaciation and anemia. Necropsy disclosed many polyps and small ulcers throughout the large intestine, and carcinoma of the transverse colon and rectum. Several polyps were present in the duodenum, ranging in size from a hemp seed to a walnut, and were composed largely of mucous cells.

Doering's article contains a summary of 50 collected cases, including his own, of polyposis of the gastrointestinal tract. In only 3 of the 50 was the duodenum involved.

In a study of polyps, adenomata and carcinomata of the intestinal tract Versé,[14] in 1908, reported a case in which two adenomata were found in the duodenum. The patient was a woman, aged thirty-two, who was admitted *in extremis*, with

an unsatisfactory history. One tumor appeared as a grayish-white thickening in the mucosa 1.0 × 1.5 cm. located on the posterior wall about 3 cm. from the pylorus. A similar rounded thickening 0.7 cm. in diameter was found about 5 cm. from the pylorus and 2 cm. from the papilla of Vater. Both were composed of Brunner's glands. Multiple polyps were found in the cecum, colon and rectum. Versé states that he was able to find only 3 instances of benign neoplasms in the small intestine in the large material at the Pathological Institute in Leipzig. Only in the above described case were they present in the duodenum.

Winternitz and Boggs,[21] in 1910, reported a case in which multiple subcutaneous hemangio-endotheliomata were associated with multiple lymphangio-endotheliomata of the intestinal tract, including the duodenum, and with multiple polypi of the stomach undergoing malignant changes.

Wechselmann,[17] in 1910, mentions a cauliflower-like polyp the size of a walnut which was found close to the pylorus on the greater curvature side of the stomach in a man aged sixty-two who died of bronchopneumonia. The stomach was markedly dilated. A similar tumor was found in the duodenum, the exact location not being noted. Three smaller tumors were present in the upper part of the jejunum and innumerable polyps in the colon. Those from the stomach and duodenum were composed of mucous cells.

Weishaupt,[18] in 1916, described a pea-sized tumor on the posterior wall of the duodenum just beyond the pylorus in an infant eleven days old. At the level of its attachment, the circular muscle of the duodenum was much hypertrophied, producing a narrowing of the lumen. Microscopic examination showed the tumor to be composed of Brunner's glands in a stroma of fibrous tissue and muscle fibers.

Carman[2]* reported in 1921 a sessile hemangioma of the first portion of the duodenum. The patient was a woman twenty-two years old, who had chronic dyspepsia from childhood, characterized by attacks of nausea and marked frontal headache followed by vomiting of sour material and relief. During the previous eighteen months she had two attacks of acute indigestion with diffuse epigastric pain and soreness. The roentgen-ray examination disclosed a rounded area of diminished density in the barium-filled duodenal bulb which suggested a polyp. At operation a sessile hemangioma 4 × 5 cm. was found attached to the duodenal side of the pyloric ring.

Camp,[1] in 1924, reported a case of myoma of the duodenum. A man, forty years of age, had had a dull pain in the abdomen for two years coming on one to two hours after meals. Six months previous to admission, he had a slight burning pain in the epigastrium, followed by a tarry stool. Two weeks previous to admission he had a second hemorrhage. Roentgen-ray examination disclosed a more or less circumscribed deformity and filling defect of the first portion of the duodenum which was considered suggestive of benign tumor, possibly of a papillomatous growth. No six hour gastric residue was found. At operation the myoma measured 2 × 2 × 1.5 cm. and involved the first portion of the duodenum and the pylorus with an ulcer 1.5 cm. in diameter on its mucous surface.

Willis and Lasersohn,[20] in 1925, reported 2 instances of adenoma of the duodenum. The first patient was a colored man, aged sixty-three, who for two months had dull severe epigastric pain with nausea, worse when the stomach was empty. He lost 15 pounds in weight during this interval of time. Roentgen-ray examination disclosed an annular filling defect close to the pylorus. A well-filled duodenal bulb could not be obtained and this structure seemed to be irregular. At the six hour period, no evidence of gastric retention was found. At operation a tumor weighing 12 grams was found in the duodenum, attached by a pedicle 1 inch long to the posterior wall of the duodenum about 1 inch distal to the pylorus. By manipulation it could be forced back through the pyloric sphincter. Microscopic examination showed it to be

*This case is erroneously reproduced as a fibroma of the duodenum in Schittenhelm's Lehrbuch de Roentgen Diagnostik, Vol. II, p. 881 (Berlin, 1924) and the date of the reference is given as 1922.

made up of the structural elements of Brunner's glands. The second patient was a woman of sixty-two, who had attacks of gallstone colic for several months and jaundice for one month. At operation a gallstone was found projecting from the papilla of Vater. Incidentally a sessile tumor about the size of a filbert was found in the second portion of the duodenum, attached to the posterior wall about an inch above the papilla. Microscopic examination showed it to be made up of fibrous tissue and blood vessels. Its surface was covered by simple columnar epithelium arranged as gland tissue.

FIG. 1. Case 1. Top row: Films of the duodenal bulb Feb. 9, 1926. The polyp produces a round area of diminished density, a "vacuole" in the barium shadow.

Middle row: Feb. 24, 1926. The area of diminished density in the bulb was clearly demonstrated at the roentgenoscopic examination. On two of the three films it is practically obliterated by the large amount of barium.

Bottom row: Nov. 30, 1926, three months after the removal of the polyp and a Horsley pyloroplasty. The mucosal folds of the duodenal bulb are markedly exaggerated.

CASE REPORTS

CASE 1. (Unit No. 65356.) A mechanic, aged thirty-nine, of Scotch descent, came to the Out-Patient Department of the Presbyterian Hospital, New York City, on Dec. 4, 1925, complaining of pain in the stomach. For four to five years he had had epigastric pain located

a little to the left of the midline and coming on three to four hours after meals, with burning eructations and belching of gas. It often awakened him in the middle of the night. It was relieved by most foods, but was aggravated by sour and sweet things. He had lost 8 pounds in two months.

FIG. 2. Case 1. Photograph of the duodenal adenoma after it was cut in two and portions removed for microscopic examination. Dime at upper right for comparison of size.

Physical examination disclosed nothing of importance.

The test meal disclosed a total acidity of 98 c.c. and a free hydrochloric acid content of 76 c.c. with considerable mucus. Gastric contents and stool gave a negative guaiac test for blood. The urine was negative.

Roentgen examination of the gastrointestinal tract disclosed a hypertonic stomach with overactive peristalsis. No irregularities of outline or filling defects were seen in the gastric shadow. No six hour gastric retention was found. The duodenal bulb filled out smoothly and flexibly. In it, however, was a rounded area of diminished density like a vacuole in the barium shadow. This could be moved slightly by the palpating finger, but could not be pushed along into the second portion of the duodenum. The remainder of the examination disclosed nothing abnormal. This was interpreted as a small tumor fixed to the wall of the first portion of the duodenum, probably a polyp. A confirmatory examination three weeks later disclosed the same vacuole in the shadow of the duodenal bulb.

Operation was performed by Dr. Allen O. Whipple on March 26, 1926. The operative note says, in part: "Situated in the first portion of the duodenum on the anterior surface about 2 cm. from the pylorus was found a polyp measuring about 1 cm. in diameter and about 0.5 cm. in height. The base was somewhat smaller than its greatest diameter. Except for this no other abnormality of the duodenum was found." The tumor was removed and a Horsley pyloroplasty was done.

The day following operation his temperature rose to 101°F. and he had clinical and roentgenologic evidence of a limited area of bronchopneumonia in the right lower lobe. Aside from this his convalescence was uneventful.

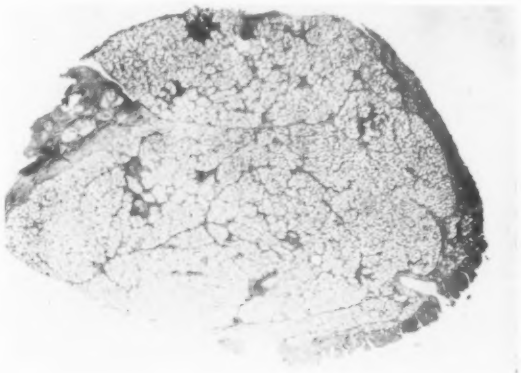

FIG. 3. Case 1. Low power view of a section through the duodenal adenoma. The mucosa covering it has been torn off in places. The tumor is composed of Brunner's glands.

The pathological report follows. "The specimen consists of a small spherical mass of firm red tissue measuring 1 cm. in diameter with a soft pedicle at one side continuous with a thin membrane covering the spherical body. On section, this covering is about 1 mm. thick. Inside of it is firm white homogeneous tissue dotted with small blood vessels. Microscopic examination discloses a vascular congested mucosa containing lymphocytes and a number of eosinophiles. The mucous membrane is intact and well developed. The muscularis mucosae is well formed. Beneath it there is a great hyperplasia of duodenal [Brunner's] glands making up the larger part of the nodule. On the side of the section away from the mucosa are a few areas of dense vascular fibrosis in which are lymphocytes, scattered and in large clusters, and a few scattered glands. The hyperplastic duodenal glands show a uniform regular structure with delicate vascular strands of connective tissue and lymphocytes in small clusters between them. There is no evidence of malignancy. Diagnosis: Adenoma of the duodenum."

A note on May 6, 1926, about five weeks after the operation, states that the patient was having pain about an hour and a half after meals and occasionally during the night.

On Nov. 4, 1926, he stated that he felt well. His appetite was good but he was careful in

selecting his food. He was troubled with pain from gas but got relief by belching. He said that he had been much benefited by the operation.

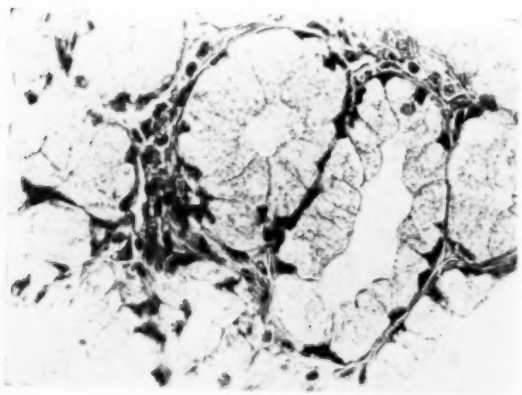

Fig. 4. Case I. High power view of a section of the duodenal adenoma. The glandular arrangement of the cells is clearly shown.

Roentgen examination on Nov. 30, 1926, showed the duodenal bulb to be large and flexible. The small indentations on its margins due to mucosal folds were very numerous and exaggerated. There was no evidence of ulcer.

On Dec. 3, 1926, his only complaint was epigastric bloating and some belching. He did not return for further observation.

Case II. (Unit No. 70195.) This case was reported by Dr. Wm. Barclay Parsons, Jr., to the New York Surgical Society on Feb. 22, 1928, and will be published in the transactions of that Society. Because of its unusual roentgenological interest it is repeated here.

A colored man, aged forty-one, came to the emergency ward of the Presbyterian Hospital Nov. 5, 1927, complaining of nausea and vomiting.

The past history is of no importance.

For many years he had had a feeling of discomfort and a sense of distention after eating, and chronic constipation. About four months previous to admission these symptoms increased in severity and were accompanied by sour gaseous eructations. He was admitted to another hospital for eight days where he improved to some extent without any special treatment. Three weeks later the epigastric discomfort and eructations returned with greater severity, relieved occasionally by vomiting. He was readmitted to the same hospital for nineteen days with some improvement. During the six weeks following his stay in the hospital he felt fairly well and gained 6 pounds. His symptoms then returned and became gradually worse so that just before admission to this hospital he was unable to retain either liquid or solid food. During this period of about four weeks he had occasional

Fig. 5. Case II. A film of the stomach with the patient upright after the change in gastric contour described in the report had taken place. The spasm of the lower part of the antrum remains. During two prolonged roentgenoscopic observations not enough barium passed out of the stomach to determine the condition or even the exact position of the duodenal bulb. The barium taken six hours previously is in the ileum and cecum.

gnawing epigastric pain alternating with a "burning" sensation, induced by food and relieved by vomiting. He had lost about 40 pounds in weight during four months. For six weeks he had not attempted to take solid food.

Physical examination disclosed emaciation and dehydration. The abdominal wall was very thin and peristalsis could be seen in various places. The soft liver edge could be seen and felt 3 cm. below the costal margin. At times a rather indefinite mass was felt just to the left of the spine in the epigastrium.

Blood examination was as follows: Hgb, 90 per cent; red blood cells, 6,100,000; white blood cells, 5,700. The differential count was normal. The smear was negative except for some variation in the size of the red cells.

Repeated tests for occult blood in the stool were strongly positive.

Roentgen-ray examination of the stomach on Nov. 17, with the patient in the horizontal

positions only, disclosed a very marked spasm of the lower end of the stomach. At times very active, deep peristalsis was present but very little barium passed into the duodenum which could never be satisfactorily seen. No six hour gastric residue was present.

FIG. 6. Case II. Photograph of the polypoid tumor of the duodenum. The ruler is divided in inches.

A second examination was done on Nov. 22 after the patient had received 1.0 c.c. tr. belladonnae t.i.d. for four days. The spasm of the lower end of the stomach seemed even more marked. The gastric shadow seemed to end at about the junction of the media with the antrum. Very active peristalsis above this failed to propel any of the barium suspension onward. With the patient lying in the right prone position, amyl nitrite was administered. After the second or third whiff the active peristalsis ceased abruptly. Two or three minutes after the drug was removed a shallow wave was seen on the lesser curvature, a few seconds later a slightly deeper wave appeared and soon peristalsis was going on as before. The lower end of the stomach seemed to relax only a little. It appeared as a narrow channel which curved downward and seemed to point back to the left. Occasionally a little barium passed through, but the duodenum was never satisfactorily demonstrated. A little later, with the patient again in the upright position, the stomach seemed suddenly to relax and assumed an essentially normal contour. No barium, however, passed into the duodenum. Palpation was contraindicated because of the hemorrhage. The second portion of the duodenum appeared dilated. No six hour gastric residue was present.

These examinations seemed to indicate that the stomach was normal except for the remarkable spasm of its lower end, the cause of which was not clear. Because so little barium had been expelled during the observations it was felt that no conclusions in regard to the duodenum could be drawn. A third examination about two weeks later was requested but not obtained because of the patient's condition.

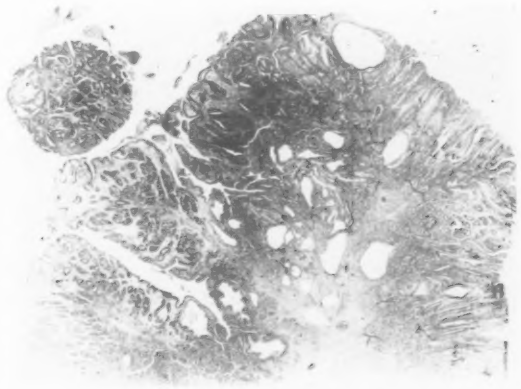

FIG. 7. Case II. Low power view of a section through one of the polypoid masses showing the numerous folds and projections of mucosa with connective tissue stroma and cyst-like formations.

A barium enema disclosed nothing abnormal.

Proctoscopic examination disclosed a small polyp in the rectum which was removed.

During the succeeding three weeks the patient's rectal temperature occasionally went slightly over 100°F. and his pulse rate varied between 80 and 100 per minute.

His condition gradually became worse. He vomited large quantities of watery material and had attacks of severe epigastric pain. During the first week in December he lost 10 pounds in weight.

Exploratory laparotomy was performed by Dr. W. Barclay Parsons, Jr., on Dec. 13, 1927. The incision into the peritoneal cavity was made through the right rectus muscle under local anesthesia. Spasm of the antrum of the stomach was observed. The pylorus was thickened. The first portion of the duodenum was markedly enlarged, being about 7 cm. in diameter. Within it was a large flexible tumor mass which could be pushed partially back through the pylorus. Ethylene was then administered and an incision was made through the pylorus into the stomach and duodenum. The tumor, a large polyp arising from a long base, was removed.

The pathological report is in part as follows: The specimen is a duodenal polyp measuring 8.5 × 5.5 × 4.5 cm. It is a multilobulated and

pedunculated mass having a broad pedicle which measures 1.0 × 4.5 cm. The surface of the tumor is divided into many polypoid masses which vary in size. The whole mass is rather soft and can be bent upon its pedicle. Microscopic examination of sections through the pedicle and one of the pedunculated masses of polyp shows an area of Brunner's glands which appear normal except for marked thickening. Farther away from the pedicle numerous folds and finger-like projections of mucosa are seen; the glands here are very long and extend in irregular fashion into the submucosa. The mucosal glands are very abundant. Occasional cyst-like formation of the glands is seen. Occasional hemorrhagic areas are present near the surface. The blood vessels are numerous and dilated. There is a marked round cell infiltration throughout the connective tissue septa. Occasional small amounts of lymphoid tissue are found. This is a duodenal polyp composed of mucous cells.

The patient made a remarkably smooth postoperative recovery. He was discharged on Jan. 2, 1928, apparently symptom-free. Two months later he was feeling very well and had gained 30 pounds in weight.

COMMENT

In a number of the cases herewith reviewed the tumors of the duodenum were associated with pathological conditions elsewhere (colonic polyposis with carcinoma, cholelithiasis, etc.), which dominated the clinical picture. In other instances they were apparently responsible for gastric disturbance. Their number is too small, however, and the details of the symptoms given in the reports are insufficient to indicate anything characteristic which from the history might be considered suggestive of such a tumor. As in our Case 1, the symptoms may be as suggestive of duodenal ulcer as they are in many ulcer cases. Intestinal bleeding may be present as in Camp's case and in our Case 11.

The barium meal seems to offer the only preoperative means of detecting the presence of a non-malignant tumor of the duodenum. The diagnosis in Case 11 was apparently impossible because the marked antral spasm prevented the opaque material from passing out in large enough quantities during the periods of observation to permit the identification and study of the duodenal bulb. Where the tumor is smaller, however, and the physiological conditions are not so disturbed, a filling defect, a "vacuole" in the barium shadow of the first portion of the duodenum, which is quite different from the deformity of duodenal ulcer, suggests such a growth.

Sessile tumors arising in the stomach, as Eliason, Pendergrass and Wright[3] have shown, may prolapse through the pylorus into the duodenum and give a very similar defect in the barium shadow. It is of interest that they found a six hour gastric retention invariably present in that condition and with prolapse of redundant gastric mucosa through the pylorus. In 4 instances of non-malignant tumor arising in the duodenum, six hour gastric retention was absent (in our cases at two observations each). This is of particular interest in Case 11 in view of the striking antral spasm. Herman and Von Glahn[5] reported a sessile adenocarcinoma arising in the duodenum just beyond the pylorus which did not produce a six hour retention. The number of these cases is too small to be conclusive, but they suggest that a polypoid mass arising in the duodenum is unlikely to produce a six hour gastric retention while a similar growth arising in the stomach and prolapsing into the duodenum will probably delay the emptying of the stomach.

SUMMARY AND CONCLUSIONS

(1) In a review of the literature 17 cases of non-malignant tumors of the duodenum were found. Case reports of 2 more are added.

(2) The ages of the individuals varied from eleven days to seventy-five years.

(3) The tumors include 6 adenomas composed of mucous cells; 5 adenomas composed of Brunner's glands; 3 myomas, 2 of which were ulcerated; one calcified fibromyoma; one fibroadenoma, the character of the cells not mentioned; one composed of fibrous tissue and blood vessels covered by glandular epithelium and termed adenoma; one hemangioma; one lymphangio-endothelioma.

(4) A non-malignant tumor of the duodenum may be the cause of gastric symptoms and hemorrhage.

(5) In 3 instances the diagnosis has been

made by roentgen-ray examination and demonstration of a "filling defect" in the shadow of the barium-filled duodenal bulb.

(6) Surgical removal of the tumors in the 2 cases reported was followed by relief of symptoms.

(7) Although the number of cases is too small for a positive conclusion it seems that, in the presence of a filling defect in the duodenal bulb suggesting non-malignant tumor, a six hour gastric retention may be considered as evidence in favor of a growth arising in the stomach and prolapsing into the duodenum, and the absence of such a retention, of a growth arising in the duodenum itself.

I am greatly indebted to Dr. A. P. Stout of the Department of Surgical Pathology for the photographs and photomicrographs of these tumors.

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ROENTGEN FINDINGS IN NEUROBLASTOMA

REPORT OF TWO CASES*

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TWO cases of neuroblastoma came recently to the Mt. Sinai Hospital which were of interest because of the striking similarity of their roentgen findings. With the recollection of the first experience in mind, the roentgen-ray diagnosis of neuroblastoma was suggested in the second case, subsequent autopsy proving it to be correct. Reports of cases of neuroblastoma are not infrequent in the literature. Probably the first case to be reported was that of Dalton[2] in 1885, but the description was incomplete. Marchand[10] in 1891 presented a more accurate report, though the full significance of the neoplasm was not recognized. This and subsequent cases were considered as sarcomas or gliomas until Wright,[19] in 1910, recognized the neurogenic nature of the neoplasm and applied the name "neuroblastoma" to a series of 12 cases culled from the literature, in addition to 2 of his own. Since that time cases have been reported with increasing frequency until, at the present, about 50 can be collected.

Neuroblastomas are tumors arising from the formative cells of the sympathetic nervous system and may occur in any site in which sympathetic ganglion cells are found. The most frequent location is the adrenal, but cases have been reported in which the primary tumor occurred in the intestines, paravertebral ganglia, and uterus.

The disease occurs principally in infants and young children, but adults may also be affected. Its course is rapidly fatal. The primary tumor is usually circumscribed, depressing, but not invading the kidney on which it rests. A tab of normal adrenal cortex can always be found.

Histologically the tumor is very cellular, the characteristic cell resembling the primitive migrating cells of the sympathetic nervous system. It is somewhat larger than a lymphocyte, with a densely chromatic nucleus, and a narrow rim of cytoplasm. The matrix in which the cells rest contains delicate fibrillae which do not take the stain of connective tissue, collagen, or neuroglia. They are probably primitive axis cylinders. The cells often assume a roughly circular formation about a bundle of fibrillae. These characteristic "rosettes" are found in the primary tumor, but not usually in the metastases. More mature ganglion cells may also occasionally be seen.

Two main types of the tumor are recognized: (1) that described by Pepper[11] in 1901 with metastases in the liver, and (2) the more disseminated, somewhat more slowly growing form, described by Hutchison[4] in 1907 with metastases in orbit, skull, and long bones. It is in this type that the roentgen findings are of aid in diagnosis.

Roentgenological findings in this type of case have been noted in only 2 instances. Roentgenograms in the case of Sturtevant and Kelly[14] showed only "some rarefaction of the head of the right femur," but these were taken early in the course of the disease before the development of generalized pains, cranial deformity, or exophthalmos. In Lederer's[7] child, however, Dr. Wasch notes findings which closely parallel our own. He reports "distinct osteoperiosteal changes with subperiosteal deposits of spicules at right angles to the shaft of the right femur. The left femur appears negative except for subperiosteal deposits and periosteal elevations at the upper outer border. Both legs are negative. There is definite destruction of the body, malar, and orbital processes, of the frontal bone. The parietal and occipital bones show a peculiar mottling. Other bones are negative."

CASE REPORTS

CASE 1. R. H., white, male, aged two and a half. (This case was reported by Karelitz.)[5]

Clinical Data. Admitted Sept. 6, 1925, with a chief complaint of weakness and fever of six and a half weeks' duration. The past history

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was negative with the exception of one attack of fever, convulsions, and mucus in the stools a few months before. The present illness began with swelling of the left upper eyelid, followed

Fig. 1. Case I. Roentgenograms of skull showing diastasis of frontal suture and areas of rarefaction in the bones.

one week later by a similar change on the right side. There was anorexia, generalized tenderness, and a loss of 5 lbs. in weight. Physical

Fig. 2.

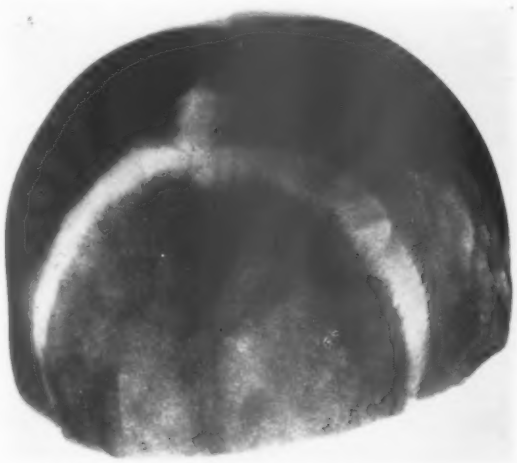

Fig. 3.

Figs. 2 and 3. Case I. Post-mortem roentgenograms of the skull cap, showing diastasis of frontal and sagittal sutures, mottling of the cranial bones, and nodular swelling of the overlying soft parts.

examination showed an emaciated child with a proptosis and ecchymosis of the left eye, and swelling of the optic disc on that side. The skull was everywhere irregular and nodular. The liver and superficial lymph nodes were enlarged. Laboratory findings: red blood cells, 2,200,000; Hgb., 35 per cent; white blood cells, 9,500; polymorphonuclear leucocytes, 56 per cent. Smear showed anisocytosis and poikilocytosis. Urine negative. Proptosis and swelling of the abdomen increased as the child grew weaker. He became hyperpneic and died twelve weeks

Fig. 4. Case II. Roentgenogram of skull. This is the typical appearance seen in both cases. Note the diastasis of the frontal suture, mottling of the bones, and the radial arrangement of the areas of rarefaction.

after admission.

Roentgen Findings. Upon admission, examination of the chest and skull revealed no abnormalities. Two weeks later there was a slight increase in the width of the coronal suture. This increased progressively on two subsequent examinations, at the last of which, taken one month before death, the roentgenogram of the skull had assumed a striking appearance. There was separation of about one-half inch between the serrated borders of

the coronal suture. The outer table was thinned and contained radial areas of rarefaction at the vertex. The calvarium appeared larger and more "porous" (Figs. 1, 2 and 3).

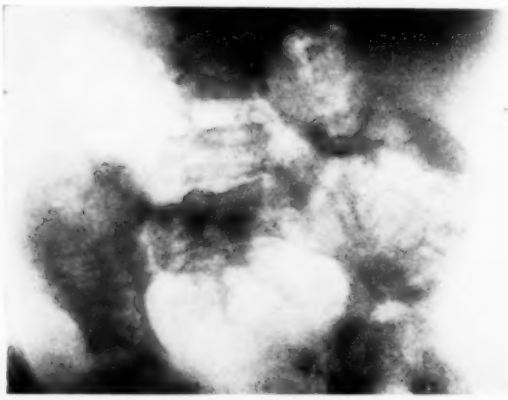

FIG. 5. Case II. Metastases in pelvic bones and heads of the femora.

Post-mortem studies of the skull cap showed diastasis of the sagittal and lamboidal sutures as well as of the coronal. The texture of the bones appeared very coarse, being studded with "pin-point" areas of rarefaction. Several nodular areas appeared in the overlying soft tissues. Delicate strands of calcified tissue extended from the bones at right angles to it. The entire osseous system was examined and appeared normal, except at the upper third of both tibiae and the lower third of both femora where periosteal elevations were seen.

Pathologic Findings. There was marked exophthalmos of the left eye, with dilatation of the temporal veins. The pupils were unequal, the right being larger than the left. On reflecting the scalp, the calvarium was studded with dark blue tumor infiltrations, except at the right temporal area. Two masses, each 2.0 cm. in diameter, overlay the right frontal lobe and depressed it. The tumor may have been broken through the dura in this place, but elsewhere the periosteum and dura were elevated by it but not broken. Infiltrations were also found in the lateral wall and floor of the anterior and posterior fossae, in the cribriform plate, in the left and, to a lesser extent, in the right retro-orbital plate. The coronal suture was widely gaping.

Along the vertebral column from the level of the eighth to the tenth dorsal vertebrae was a firm, greyish-white tumor mass which was adherent to the periosteum. The pre-aortic lymph nodes showed similar changes, while the mesenteric nodes were large, firm, and hemorrhagic. Microscopically this primary tumor showed islands of loose cellular tissue imbedded in dense connective tissue. The cells appear to be primitive nerve cells, some having rounded bases with pointed apices over which a fine fibrillar process extends. Numerous mature ganglion cells can be seen. The ground substance is granular and contains fibrillae, loose and in occasional bundles. No rosettes were found in the primary tumor but a few were seen in the skull nodules.

The pancreas and perirenal tissues presented microscopic collections of tumor cells. In the femur the bone was involved in the process, but the periosteum appeared to be free. In the brain small ring-like accumulations of neuroblastomatous and gliomatous cells were found in the white matter, bearing no relation to blood vessels. A large nodule overlay the aqueduct of Sylvius which showed the structure of mature pineal gland.

Pathological Diagnosis. Ganglioneuroma and neuroblastoma arising in the paravertebral sympathetic plexus and pre-aortic ganglion. Metastases of neuroblastoma in skull, brain, and kidney. Pinealoma and multiple gliomata of brain.

CASE II. L. E., negro, male, aged seven. Admitted June 17, 1927; died June 17, 1927.

Clinical Data. Past history and development were normal. Four months prior to admission the patient had had migrating tenderness of the joints. Three weeks before admission a mass appeared on his head. Two weeks later he became stuporous. The day before admission it was noted that his eyes protruded. On physical examination the boy appeared cachectic, with a large abdomen. His scalp had a moth-eaten appearance; and there was a pitting edema of the forehead. On palpation, the coronal suture was found separated about 1 cm. Both eyes protruded, the right more than the left. On the posterior portion of the calvarium in the midline there was a mass about 3 cm. in diameter. The liver was greatly enlarged, the lower border being at the level of the umbilicus; it was hard and regular. There was a systolic murmur at the cardiac apex, and a diastolic atthe pulmonic area.

Roentgen Findings. Examination of the skull showed multiple minute areas of bone rarefaction throughout the entire cranial vault, with very marked diastasis of the coronal suture. Similar areas of rarefaction were seen in both ilia, and in both femora, especially the upper portions. In both femora and in the left ilium delicate calcifications were seen extending into the soft tissues at right angles to the parent bone (Figs. 4, 5 and 6).

Pathologic Findings. Autopsy showed the following: The primary tumor was a mass the size of a baseball, replacing the right adrenal,

and resting upon, and depressing the kidney. Microscopically it was composed of a white part consisting of nerve fiber tissue with a small number of cells resembling ganglion cells, and a dark red part consisting of large oval cells with dark nuclei and no definite cytoplasm. The cells were isolated, or in solid groups without definite rosette formation. Occasional mitoses were seen. Metastases of both types replaced the normal liver tissue and were plentiful in the pancreas. Other metastatic foci were the left adrenal, peritoneum, pleura; mediastinal, retroperitoneal and inguinal lymph nodes; ribs, and vertebrae. The infiltrations were of the dark red hemorrhagic type.

The cranium was not opened.

Pathological Diagnosis: Neuroblastoma of the right adrenal with metastases to liver, pancreas, lymph nodes, peritoneum, bone and left adrenal.

FIG. 6. Pelvis and femora of Case II. Note radial areas of bone production in the left ilium and along the shaft of the right femur.

COMMENT

Two cases of neuroblastoma are described; one with the primary tumor in the adrenal, and one which was primary in the paravertebral ganglia. Both showed metastases to bone and soft parts; each showed a striking cranial roentgenogram which had several points in common:

(1) In each the coronal suture was gaping widely, probably evidence of

increased intracranial pressure secondary to brain metastases.

(2) Each presented a "porous" appearance due to generalized pin-point areas of rarefaction; seen sagittally, these rarefactions assumed a radial appearance.

(3) They resemble a case reported by Lederer,[7] making a similarity of findings in 3 of the 4 recorded cases of the Hutchison type in which roentgen findings have been noted.

The second case illustrates an observation that has previously been made, namely, that neuroblastomata of the adrenal are associated with involvement of the orbit of the same side. If both orbits are affected, the more extensive involvement is found on the side of the primary tumor.

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COLLAPSE OF THE LUNG OCCURRING IN PULMONARY TUBERCULOSIS

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A RATHER careful search of the English literature has failed to show any investigation of pulmonary collapse occurring in tuberculosis during adult life. That the condition does occur in early childhood is known, and has been seen by Manges[1] at the Jackson Clinic, also a case has recently been reported by Bucher.[2]

The phenomenon of pulmonary collapse in tuberculosis in young children is supposedly due to external pressure of glandular structures, producing stenosis of a bronchus.

At a recent meeting of the New England Roentgen Ray Society Sampson[3] of the Trudeau Clinic showed films of massive collapse of the lungs in association with pulmonary tuberculosis. It is of interest to note that in these cases no bronchoscopic observations were made to ascertain the cause of the collapse.

The characteristic roentgen findings in collapse of the lung are practically the same in all cases, independent of the variation in the causative factor producing the collapse.

The changes usually seen are narrowing of the intercostal spaces on the affected side, elevation of the diaphragm, or inability to visualize it, increase in density corresponding to the area of lung collapsed, and of paramount importance, displacement of the heart, mediastinum and trachea toward the affected side.

It is not intended in this paper to enter into a discussion of the mechanism of pulmonary collapse, except to say that in collapse, other than the so-called post-operative massive collapse, bronchial stenosis is the essential causative factor.

The following case came under the observation of the writer, and is reported because of its interest and also because so little has been written of the condition of pulmonary collapse in adult tuberculosis.

CASE REPORT

Miss W., aged twenty-four. Singer. Referred Feb. 6, 1928, by Dr. Henry Kapp of Haverhill, Mass., for roentgen-ray examination of the lungs. The patient's principal complaints were loss of voice and hoarseness.

History. The patient was perfectly well until eight months ago, when she noticed wheezing in her chest, and hoarseness. Shortly afterwards a dry rasping cough developed, which gave way in a few weeks to one with viscid glairy expectoration.

About a month before examination, she began to raise yellow, blood-streaked material, and this has continued to date. At one time she expectorated a teaspoonful of blood. She has had no pain in her chest, but is always conscious of a feeling of oppression and difficulty in breathing. She gave no history of inhalation of a foreign body. Roentgen examination at this time (Figs. 1 and 2) showed the outline and movement of the left half of the diaphragm normal, the costophrenic sinus clear, and the left lung field clear and radiant throughout.

On the right side, the outline of the diaphragm could not be made out, there was evident narrowing of the intercostal spaces, and marked increase in density in the lower half of the lung field. The whole lung field appeared contracted, and there was some diminished radiance in the upper half.

The heart, mediastinum and trachea were markedly displaced toward the right (the affected side), so much so that the left border of the heart was at the left margin of the vertebral column.

The findings were interpreted as those of collapse of the lower lobe of the right lung, due to stenosis of the right descending bronchus, and the causes most likely to produce such a condition were enumerated as primary intrabronchial neoplasm, non-opaque intrabronchial foreign body, and extrabronchial tumor creating pressure from without.

Bronchoscopy was advised and the patient was referred to a bronchoscopic clinic.

Sputum examination at this clinic showed the presence of the tubercle bacillus on two separate days and for this reason bronchoscopy was refused.

Consultation was then held with another roentgenologist and after due consideration it was decided that in spite of the presence of tubercle bacilli in the sputum bronchoscopy was advisable to determine the cause of the pulmonary collapse.

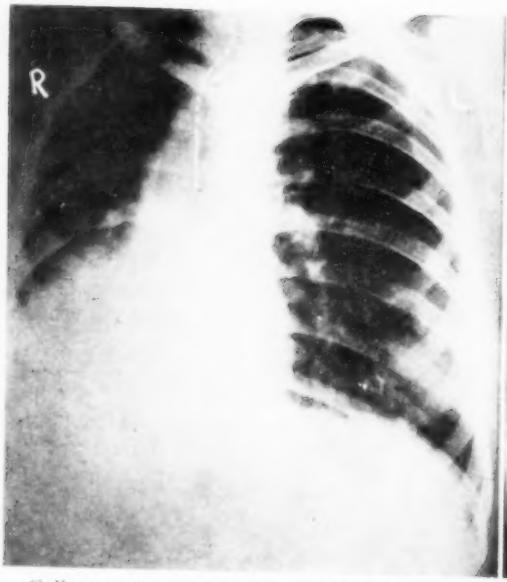

Fig. 1. Collapse of the lower lobe of the right lung. Note the narrowing of the intercostal spaces on the right, the absence of the outline of the diaphragm on this side, the marked displacement of the heart, trachea and mediastinum toward the right (the affected side). The left border of the heart is at the left margin of the vertebral column.

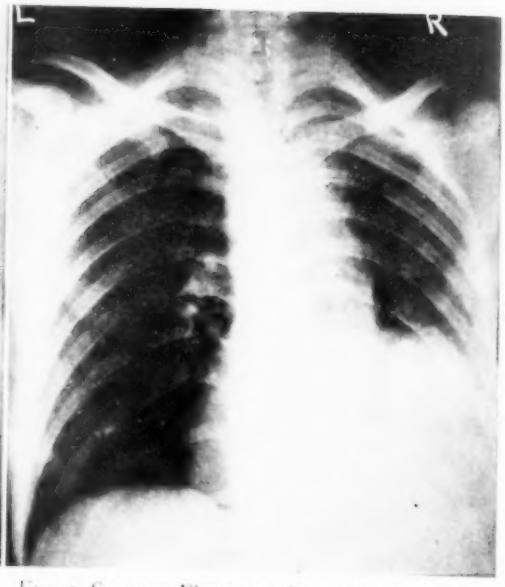

Fig. 2. Same as Figure 1 taken with the dorsal surface of the patient next the film.

Fig. 3. Same case as Figures 1 and 2, but taken just before bronchoscopy. Compare with Figures 1 and 2 and note the added increased density in the right upper lung field, the more marked displacement and distortion of the trachea and the more marked narrowing of the intercostal spaces. The mediastinum is also more displaced. Findings show collapse is now taking place in the whole lung and suggests stenosis of the right main stem bronchus.

Fig. 4. Same as Figure 3 but taken with the patient's dorsum next the film.

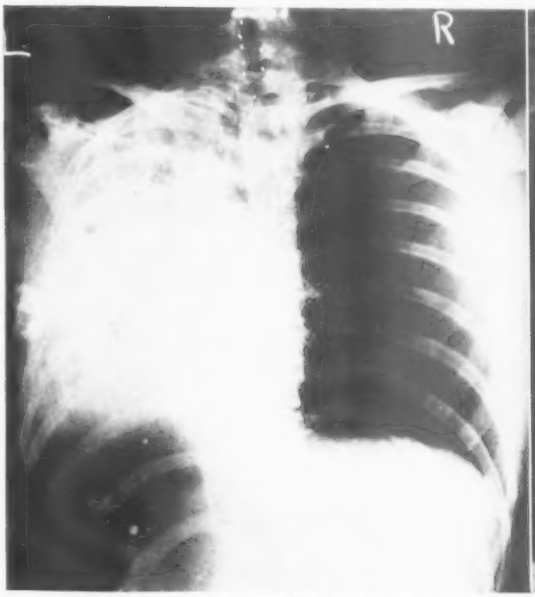

FIG. 5. Another case suggesting collapse of the lung in pulmonary tuberculosis; this time on the left side. Note that the involvement is apparently unilateral and that there is marked displacement of the heart, mediastinum and trachea toward the left, the affected side. Findings suggest collapse of the left lung due to stenosis of the left main stem bronchus. Bronchoscopy refused because of tubercle bacilli in the sputum.

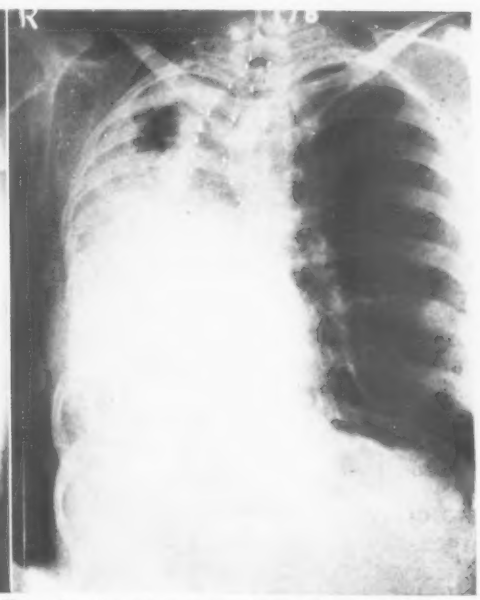

FIG. 6. Another case presenting typical roentgen appearances of collapse of the lung, this time on the right side. Note that the disease is unilateral. There is the usual absence of the diaphragmatic outline, the very marked displacement of the heart, trachea and mediastinum toward the affected side and marked increase in density throughout the whole of the right lung field. The very marked density in the lower part of the right lung field suggests fluid. Bronchoscopy refused because of the presence of tubercle bacilli in the sputum.

Bronchoscopy was again advised and sought. At this time another roentgen-ray examination was instituted, and the findings are well shown in Figures 3 and 4.

The condition of collapse of the lower right lobe with its associated well-known phenomena was still present, but, in addition, a collapse of the right upper lobe was now taking place, as shown by the increasing density of the upper half of the right lung field and the very much more marked displacement of the trachea and mediastinum toward this, the affected side.

On March 27, 1928, about six weeks from the first roentgen-ray examination, bronchoscopy was performed by Dr. Lyman G. Richards, at the Peter Bent Brigham Hospital in Boston, and his examination showed a stenosis of the right stem bronchus, without evidence of ulceration, intrabronchial tumor or foreign body. His full report was as follows:

"Laryngoscopic examination showed the larynx to be apparently normal in every respect. A 7 millimeter bronchoscope was introduced into the trachea which was found to deviate slightly to the right. Following the trachea down to the bifurcation, the left main bronchus seemed to form the main continuation of the trachea, extending downward and to the left. The entire left bronchial tree, as far down as the small subdivisions could be seen, appeared to be normal. There was no inflammatory swelling, redness, or purulent secretion. Just to the right of the bifurcation, the entrance of the right main bronchus was marked by a small dimpling in the mucous membrane, out of which purulent secretion could be seen coming, and the septum between the left and right main bronchi was thickened and flattened, so that the normal sharp edge of the carina could not be recognized. Dilation of this dimple in the mucous membrane to the right, resulted in the enlargement of the lumen of the right main stem bronchus, to about $\frac{1}{8}$ of an inch in diameter. Pus continued to pour out of this lumen. A dilating bougie could be passed well down this right side, without encountering any sudden obstruction, but finally seemed to meet gradually increasing resistance. This right bronchial lumen showed no evidence of any growth or ulceration. Its walls were smooth and apparently not much inflamed. The entire circumference appeared uniformly thickened, but it was difficult to estimate whether the lumen was narrowed by the external infiltration of the peripheral wall, or internal swelling of the mucous membrane itself. On the whole,

the former appeared to be the more likely explanation. During the entire examination there was not the slightest bleeding from this right bronchus.

"My impression of the condition is that of a right main bronchial stenosis, due probably to external pressure, possibly to internal inflammation or a combination of both these processes."

There were no unexpected effects from bronchoscopy. The patient entered the hospital one afternoon, bronchoscopy was performed the next morning, and the following morning the patient travelled forty miles to her home. She has been seen since several times by the writer, and no ill effects or aggravation of symptoms have been observed, as the result of the bronchoscopic examination.

Two other cases presenting very similar roentgen-ray phenomena have come under the observation of the writer, and although bronchoscopy was advised, it was refused because of the presence of tubercle bacilli in the sputum. Whether this is a valid reason for refusing bronchoscopy in these cases is of course undecided.

Figure 5 shows the characteristic displacement of the trachea, heart and mediastinum toward the left (the affected side), so that the right border of the heart is to the left of the vertebral column, also the increase in density extending throughout the whole left lung field, the density in the lower half being more marked than elsewhere, due to the presence of the heart shadow in this area. The diaphragm is not visualized on this, the affected side.

Figure 6 well illustrates again the phenomenon of pulmonary collapse, this time of the right lung. On the right side the outline of the diaphragm cannot be made out, there is marked increase in density throughout the whole right lung field, most marked in the lower half, due again to the presence of the displaced cardiac shadow, the trachea, heart and mediastinum are all markedly displaced toward the right (the affected side). Indeed the left heart border is at the left margin of the vertebral column. In this case, in addition to the collapse phenomena, there is some evidence of free fluid in the right pleural cavity, an observation of some importance, as regards the part played by pleural adhesions in producing cardiac displacement in adult pulmonary tuberculosis.

DISCUSSION

A case is here reported showing pulmonary tuberculosis in an adult, with collapse of first the lower lobe of the right lung, and later the upper lobe of the same lung, and this collapse was definitely proven to be due to a main stem bronchostenosis. This stenosis may be due to pressure from tuberculous glands, but the paucity of reported cases in adults verified by autopsy findings, makes this merely a reasonable hypothesis, and then only because this has been proven to be the cause of similar collapse in young children.

The roentgen-ray findings in two other cases of adult pulmonary tuberculosis are also presented, and the findings in these cases are those characteristic of pulmonary collapse due to bronchostenosis.

It is a well-known fact that for years roentgenologists had seen postoperative massive collapse of the lungs on the roentgen film, and had failed to recognize it as an entity, and it seems rather pertinent to ask whether this condition of pulmonary collapse due to bronchostenosis and associated with adult tuberculosis may not be escaping observation in the same manner as did postoperative massive collapse.

A goodly number of cases of pulmonary tuberculosis show displacement of the heart and mediastinum, in some cases the displacement of these structures being quite marked. Such displacements have been more or less empirically believed to be due to fibrosis or pleural adhesions.

In this reported case it was certainly not due to any such factors, but to definitely proven bronchostenosis, and in the other two cases the assumption of collapse due to bronchostenosis really has the weight of evidence in its favor. I am sure that any roentgenologist or clinician being told that in these cases tubercle bacilli were not present in the sputum, would immediately diagnose the condition as one of pulmonary collapse due to bronchostenosis, and would advise a diagnostic bronchoscopy to ascertain the cause of the collapse. Then why should

the opinion be changed because tubercle bacilli are found in the sputum? As against pleural adhesions or fibrosis being the cause of the cardiac displacement in these two cases, the presence of free fluid in the pleural cavity (Fig. 6) is incompatible with extensive viscero-parietal adhesions and with extensive fibrosis.

In the examination of roentgen films showing pulmonary collapse, it is well to remember that most of the increased density is due not to extensive parenchymatous infiltration, but to collapsed lung in the upper part of the chest, and to collapsed lung plus the density of the cardiac shadow in the lower half of the affected side. If these facts are not borne in mind, one may easily be misled in regard to the extent of the tuberculous process, and believe it to be much more extensive than it really is.

It would seem as if it were worth while now to review the phenomena of cardiac and mediastinal displacement in adult tuberculosis, and ascertain the importance of pulmonary collapse from bronchostenosis as a factor in producing the displacement, and by bronchoscopic examinations on the living and autopsy examinations on the dead determine if bronchostenosis is a frequent occurrence in adult pulmonary tuberculosis, and also ascertain the exact pathological changes, be they glandular, parenchymal or bronchial, which produce the stenosis.

If bronchostenosis and the consequent pulmonary collapse are definitely proven to be due to glandular pressure, then the therapeutic use of the roentgen ray on the enlarged glands might be taken into consideration, especially in view of the excellent results sometimes obtained with irradiation in the treatment of tuberculous glands of the neck.

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ROENTGENOLOGICAL DIAGNOSIS OF DIAPHRAGMATIC HERNIA*

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THE term "diaphragmatic hernia," to the average physician, applies to an acquired traumatic hernia. This condition, however, is relatively infrequent in comparison with other conditions about the diaphragm which simulate hernia in some respects. It would, therefore, be much better to teach the medical student, for example, to regard traumatic rupture or diaphragmatic hernia as unusual and to regard congenital malformations as relatively more frequent.

The distinction is particularly important in medicolegal cases, as pre-existing congenital lesions of the diaphragm are frequently mistaken for acquired traumatic conditions of the diaphragm. The distinction is also important from the surgical standpoint because certain conditions about the diaphragm cannot be corrected by surgical means. If the conditions which are amenable to surgical correction can be distinguished from true diaphragmatic hernia, unnecessary exploratory operations can be avoided.

Attention is called to the fact that extensive defects of the diaphragm, amounting at times to complete absence of half of the diaphragm, may exist without causing any disability to the individual.

*Read at the Twenty-eighth Annual Meeting, American Roentgen Ray Society, Montreal, Canada, Sept. 20–23, 1927, and at the Second International Congress of Radiology, Stockholm, Sweden, July 23–27, 1928.

Furthermore, reference to comparative anatomy readily discloses the fact that all animals, including vertebrates, up to mammals have no diaphragm.[1] Great physical strength and endurance may be present, as in the ostrich, without the presence of a diaphragm separating the abdominal from the thoracic contents.

Fig. 1. Congenital absence of left half of diaphragm. J. M., male, aged thirty-five. Lateral view. Note only right side of diaphragm is visible. Compare with Figure 6, a case of eventration of the diaphragm, where both sides of diaphragm show. For position of stomach see Figure 2.

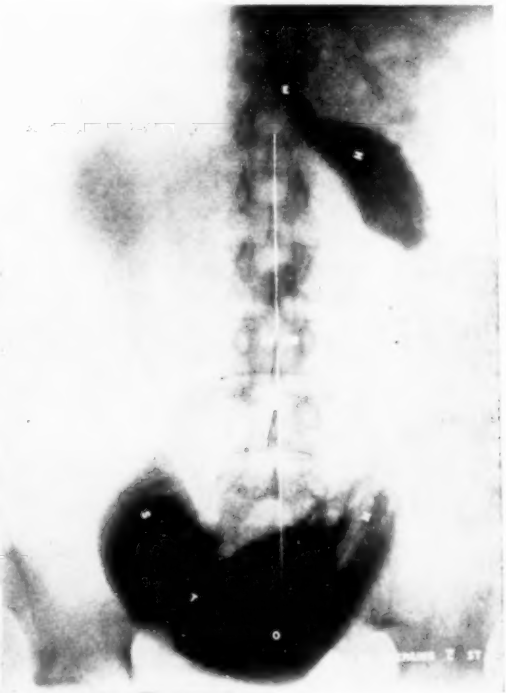


Fig. 2. Same case as Figure 1. Note esophagus merges with stomach. No gas bubble at the cardia.

The writer has at the present time under observation a man, aged thirty-four, with complete absence of the left half of the diaphragm, who has won athletic honors in long distance running contests. Furthermore, congenital absence of half of the diaphragm is not incompatible with longevity as I have under observation a woman, aged sixty-three, who has no evidence of a diaphragm on the left side so that some of the abdominal organs are in direct contact with the pericardium and left lung[2] (Figs. 1, 2 and 3).

The following classification of diaphragmatic lesions seems advisable.

Classification of Certain Congenital and Acquired Conditions of the Diaphragm

I. Absence of left half of diaphragm.
II. Thoracic stomach.
III. Eventration of the diaphragm.
IV. Congenital hernia.
V. Acquired hernia.

I. *Absence of Left Half of Diaphragm.* This condition has been recognized at post-mortem examination and has been encountered in surgical operations, but only very recently has the condition been recognized roentgenographically.[3] It is now believed that the condition can be diagnosed by means of the roentgen ray with accuracy if roentgenograms are made with this in view, especially in the lateral position. The importance of the exact diagnosis cannot be too strongly emphasized, particularly if surgical intervention is contemplated in a case supposed to be diaphragmatic hernia. Where the left half of the diaphragm is completely absent, as in the case reported by Harris and Clayton-Greene,[4] the operator found it

impossible to accomplish anything even after an incision had been made and the true condition recognized. If a correct diagnosis of complete absence of half of the diaphragm had been made, the dangerous surgical operation could have been avoided.

Attention is directed to the fact that the history of trauma should not unduly influence one in making a diagnosis of diaphragmatic hernia, as it is very easy to elicit the fact that, especially in childhood, some such an accident as a fall downstairs has occurred. In Harris and Clayton-Greene's case there was a history of the patient's having fallen downstairs five years before the operation. In some cases of congenital lesions of the diaphragm which have come under my observation, there have been noted histories such as being jarred in an automobile accident, of having been struck by an automobile, or having been in a railroad collision, but after prolonged study of the condition present in each case it was ascertained that the accident had not produced the diaphragmatic lesion in the particular individual.

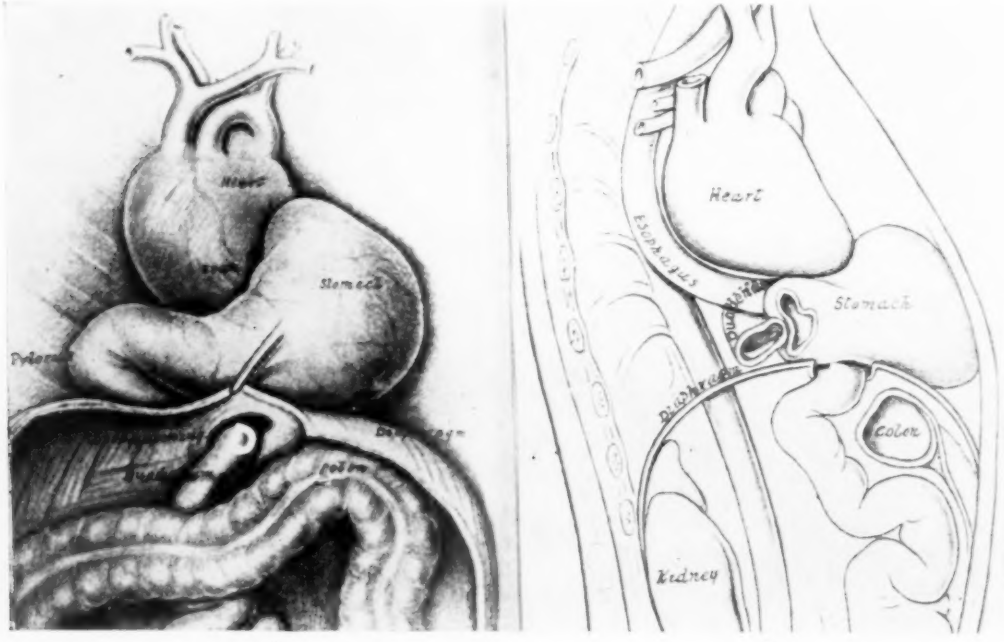
In a number of cases reported during the World War where a diagnosis of diaphragmatic hernia had been made it is not impossible that the diaphragmatic condition was of congenital nature and had not been recognized at the time of entrance into military service. It would be advisable to have a roentgen-ray examination of the chest made of all recruits for military service. In fact, the writer, then an officer in the Medical Division of the United States Army, as far back as 1910 recommended to the Surgeon General that a roentgen-ray examination of the chest be made of all applicants for West Point and of recruits for the Army and other government positions. The same would be advisable prior to acceptance of cases for life insurance involving large amounts. In cases in which lesions of the diaphragm are encountered, the record would be available later for reference in cases of alleged injury and afford a basis for correct adjustment of compensation which would be equally just to the claimant and to the defendant, for in a particular case it might be proved that the diaphragm had been intact and yet a hernia had resulted from a trauma which ordinarily would not have been considered sufficient to cause such a lesion. On the other hand, it might be proved that in a case in which a severe trauma had occurred, a previous congenital lesion of the diaphragm had been present.[5]

FIG. 3. Congenital absence of left half of diaphragm. A. R., female, aged sixty-two. Lateral view. Note only right side of diaphragm visible. Compare with Figure 7, eventration of diaphragm, which on lateral exposure shows both sides of the diaphragm. Stomach inverted and in chest cavity.

Besides determining the fact that the left half of the diaphragm is absent, it is also desirable to determine from roentgen examination the contents of the left half of the chest, as in some instances the appendix may be in this region or there may be some other marked change in the position of the other hollow or solid viscera which would be important to know in case of the occurrence of some inflammatory or other lesion. Cases have been called to the attention of the writer in which an inflamed appendix has required removal in spite of its location in the left side of the chest, and the writer has

observed cases of the presence of multiple diverticula of the colon in the left chest cavity (Figs. 1, 2 and 3).

11. *Thoracic Stomach.* The exact appearance and classification of this condition have only been properly recognized within the last few years. Previously the condition was confused with diaphragmatic hernia and had been designated in some instances as "diaphragmatic hernia of the short esophagus type."[6] Bailey[7] encountered a case in the dissecting room and reported the condition under the name "thoracic stomach" in 1923. The writer has diagnosed 2 cases on roentgen examination, one in a child, which was confirmed by operation,[8] and the other in a woman, aged sixty-nine. Recently a case was reported in England by Roberts.[9] In this condition the diaphragm is perfect in form and is intact on both sides, but the stomach is entirely within the chest cavity. The esophagus is very short and the duodenum, or in some cases the pyloric end of the stomach, passes through the opening in the diaphragm which would ordinarily accommodate the esophagus (Figs. 4 and 5).



A B

Fig. 4. Thoracic stomach. Sketch made at operation on patient (Fig. 5). Note entire stomach above intact diaphragm. Short esophagus. A—front view; B—lateral view.

No surgical intervention is necessary or advisable in treatment of thoracic stomach unless some complication occurs, such as gastric ulcer or pyloric stenosis, or in later life if a malignant growth occurs. It then becomes necessary to attempt operative relief either through an abdominal incision and secondary incision through the diaphragm or enlargement of the diaphragmatic opening,[5] or possibly by transthoracic incision. The presence of the stomach in the chest cavity does not appear to cause trouble, as observed in the woman of sixty-nine years. In this case, there was a history of the patient's having been run over by a horse and wagon, but it is believed that this circumstance had no connection with the presence of the stomach in the chest cavity. The patient stated that when she suffered from indigestion there was distress in her chest in the exact region in which the roentgen ray revealed her stomach. In the case of the child observed by the writer, the condition of thoracic stomach was complicated by pyloric stenosis, the stomach showing twenty-four hour retention. A gastroenterostomy was

successfully performed by enlarging the diaphragmatic orifice for the duodenum.

III. *Eventration of the Diaphragm.* This condition usually occurs on the left side, but at times may be found on the right side, and occasionally is present on both sides. In the latter condition, it is usually associated with megacolon. The diaphragm may be as high as the second costal cartilage, but on careful roentgen examination, especially on lateral exposures, the complete outline of the diaphragm can be made out, however high it may be. The appearance may be simulated by the upper border of the stomach in cases of congenital absence of the left half of the diaphragm, but repeated examination, particularly after complete filling of the stomach with opaque mixture, will enable one to differentiate the two conditions. In diaphragmatic hernia a portion of the stomach or the entire stomach may at times be found in the chest cavity, but the outline of the diaphragm in eventration of the diaphragm can be made out both on posteroanterior and lateral exposures (Figs. 6 and 7).

FIG. 5. Thoracic stomach. N. C., male, aged seventeen. Ten years after gastroenterostomy.

Eventration of the diaphragm is usually due to lack of proper musculature and in one case observed post mortem, the

diaphragm consisted only of the pleura and peritoneum with a small amount of connective tissue between them. Microscopic examination showed entire absence of muscle tissue. The condition has been observed in children, but usually is not noticed until it is discovered on a routine roentgen examination, or occasionally when accompanied by symptoms referable to the distention of the cardiac end of the stomach due to the trapping of gas. In these cases, clinical diagnosis of gastric ulcer or carcinoma is not infrequently made.

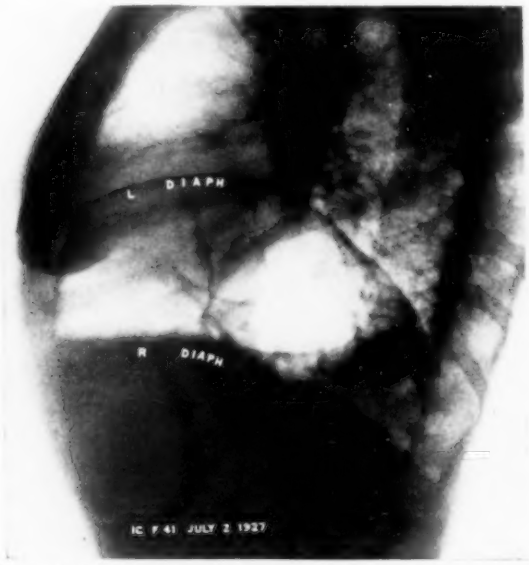


FIG. 6. Eventration of diaphragm. I. C., female, aged forty-one. Lateral view. Note left side of diaphragm is markedly elevated but intact.

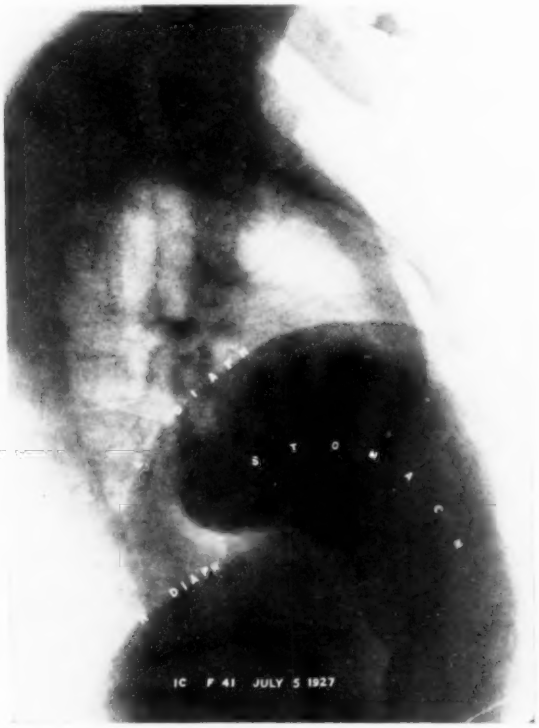


FIG. 7. Eventration of diaphragm. Same case as Figure 6. Lateral view. Note both sides of diaphragm are visible with the left side elevated. Stomach is also elevated and very close to the diaphragm.

Morison of Edinburgh classifies eventration as a variety of diaphragmatic hernia. This does not appear to be advisable, and the condition should be considered as separate from diaphragmatic hernia in the same way in which thoracic stomach is a separate condition, the diaphragm remaining intact in both cases. There does not appear to be any satisfactory surgical procedure for the relief of eventration of the diaphragm so that it is important to recognize the condition and distinguish it from true hernia.

IV. *Congenital Hernia.* A defect in the diaphragm may be present at birth, and the abdominal contents may pass into the chest cavity with or without the presence of any sac. These defects in the diaphragm usually occur on the left side, but may be present on the right side, in which case the liver may block the opening sufficiently to prevent the contents of the abdomen passing into the chest cavity. As this type of hernia is operable, it is important to distinguish it from congenital absence of half of the diaphragm, which is inoperable. This can be done by careful roentgenographic examination, especially in the lateral position and by repeated examinations at different times when it may be observed that at one time a portion of the stomach is above the diaphragm and at other times the entire stomach may be below the diaphragm. Likewise, a portion of the colon may be above and at other times the entire colon may be below the diaphragm. In complete absence of the left half of the diaphragm, there is not likely to be this extreme variation in the findings.

Pancoast and Boles[10] call attention to the relative infrequency of traumatic diaphragmatic hernia. In a recent article in which they report 15 cases of diaphragmatic hernia, they say:

"In reviewing the literature on diaphragmatic hernia, it may be noted that the condition was discovered only seven times in 25,000 roentgenologic examinations, according to the separate reports of Béclère, MacMillan, and Rendich. The Mayo Clinic records finding twenty cases up to July, 1924, or one in about every 18,000 patients examined. According to Carman, fifteen of these were found in the years 1923 and 1924. Richards has tabulated 137 cases taken from the literature from 1900 to 1923. These were all nontraumatic and of the esophageal variety. It is worthy of note that up until 1923 only 47 cases had been diagnosed during life.

"While these figures would create the impression that the condition is rare, this is not the case. The more general employment of the roentgen ray with its recent advances in diagnosis makes it apparent that diaphragmatic hernia has frequently been overlooked in the past. Morrison, for instance, detected forty-two diaphragmatic hernias in 3,500 roentgenologic examinations of the gastrointestinal tract. It is proposed in this article to confine our remarks entirely to the question of nontraumatic hernia, fifteen cases of which, all on the left side, were observed and studied by us. In all, sixteen cases, which include one of traumatic origin, were discovered in approximately 9,000 gastric cases studied.

"On the basis of an exhaustive embryologic study of the origin of these hernias, Richards has classified them as follows:

1. True hernias (those with hernial sac).
   (a) Congenital (present at birth).
   (b) Acquired (through a natural opening, usually the esophagus).
   (c) Elsewhere—traumatic or nontraumatic.
2. False hernias (without sac)—90 per cent of cases.
   (a) Congenital.
   (b) Acquired (all traumatic).
3. Eventration of diaphragm (not true hernia).

"Diaphragmatic hernia, as the name implies, is a protrusion of any of the abdominal viscera into the thoracic cavity through a congenital or an acquired opening in the diaphragm."

In Pancoast and Boles' report of cases, Case 12 is of particular interest to me, as the very low position of the stomach and the absence of a definite shadow of the left half of the diaphragm in the postero-anterior roentgenograms which they show are practically identical with one of my cases of complete absence of the left half of the diaphragm (Figs. 1 and 2).

Pancoast and Boles report this case as follows:

"Case 12.—R. C., a man, aged 27, was examined Jan. 8, 1925. His chief complaint was epigastric pain of several years' duration and recent pain in the right lower chest. An examination of the chest showed at the left base an appearance that suggested a possible diaphragmatic hernia. A gastrointestinal examination was then carried out. The examination of the stomach showed practically a complete six hour residue and we were surprised to find no hernia of this structure in any posture but, instead, a long, low, vertical stomach with the greater curvature on a level with the symphysis pubis. There was a marked intermittent hyperperistalsis with antiperistalsis and no motility, except that in the right lateral recumbent posture it was fairly free. This indicated no pyloric stenosis but suggested that the obstruction was probably mechanical, due to kinking. On the following day most of the opaque contents in the colon were found in the thoracic cavity. A subsequent barium enema showed all the colon except the descending portion and sigmoid to be herniated through the left diaphragm. After evacuation, the entire large bowel was empty of opaque contents. This case is unusual in the fact that the colon was herniated and the stomach was extremely ptosed. The ileum was never located."

In concluding this article, it is stated:

"Diaphragmatic hernia is not as rare as is commonly thought. The more general employment of the roentgen ray with its recent advances in diagnosis make it apparent that the condition has been frequently overlooked.

"Sixteen cases were discovered by one of us in approximately 9,000 gastric cases studied. Fifteen were nontraumatic and on the left side. Twelve were through the esophageal opening. Three were central, and one was probably central.

"The diagnosis can be made with certainty only by means of the roentgen ray studies. In the roentgenographic examination of gastrointestinal cases the studies should be made after a barium meal, first with the patient in the erect position, thus obtaining anteroposterior and oblique views, and then observations should always be made in the horizontal position. More than one examination may be

required. Subsequent studies of the colon should be made in order to determine whether or not it is included in the hernia.

"The symptoms may be respiratory but are usually gastrointestinal. The most common and suggestive symptom is pain above the ensiform or in the epigastrium, which comes on particularly in the recumbent position and at night. Regurgitation when in the supine position usually accompanies the pain.

"The recognition of the presence of diaphragmatic hernia is of great value in saving many patients an unnecessary operation for cholecystitis, peptic ulcer, and other common lesions which are often thought to be the cause of their symptoms."

v. *Acquired Hernia.* This may occur through the esophageal orifice due to gradual relaxation of this opening. A number of cases of this sort have been reported by Morrison of Boston and Jenkinson of Chicago. This type of hernia is operable. The condition may be diagnosed by careful roentgenoscopic and roentgenographic examination, particularly with the patient in a horizontal position or in a slightly inverted position. Sometimes it is necessary to have the patient cough or strain in order to force the cardiac end of the stomach into the chest cavity alongside of the esophagus. When searching for this condition, it is well to have the stomach completely filled and, in addition, to have the patient take an opaque mixture at the time of the roentgenoscopic examination. Occasionally the condition may be suspected on ordinary roentgenoscopic examination with the patient in the vertical position, by the fact that there is absence of the usual gas bubble at the cardiac end of the stomach. This condition, however, is sometimes seen in cardiospasm, but the cardiospasm can usually be recognized by the dilated condition of the esophagus.

Occasionally, some other portion of the digestive tract passes into the dilated esophageal opening. In one case observed by the writer, the splenic flexure of the colon passed through the esophageal orifice into the chest cavity.

Lastly, the question of diaphragmatic hernia due to traumatism requires consideration. As previously mentioned, the mere fact of a history of a sudden or severe blow on the abdomen, associated with the roentgen-ray evidence of abdominal contents in the chest cavity should not be taken as positive relationship of cause and effect, as a congenital hernia may have been present and not recognized prior to the time of the roentgen-ray examination made subsequent to the injury. One observer has gone so far as to state that the differential diagnosis can be made only by removal of a section of the diaphragm at the edge of the opening and an effort made to determine by the presence of scar tissue whether or not the opening was due to trauma.

CONCLUSIONS

1. When diaphragmatic hernia is suspected from physical or roentgen examination, it is necessary to make an unusually careful roentgen examination, particularly with the patient in a lateral position, in order to differentiate a true diaphragmatic hernia from thoracic stomach, eventration of the diaphragm, and congenital absence of half of the diaphragm.

2. Thoracic stomach is an entity and can be differentiated from diaphragmatic hernia by roentgenological examination.

3. Eventration of the diaphragm is relatively frequent and can be differentiated from diaphragmatic hernia by lateral roentgenographic examination.

4. Diaphragmatic hernia is to be regarded as congenital unless proven to be of traumatic origin.

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HYSTEROSALPINGOGRAPHY AND THE DIAGNOSIS OF ECTOPIC PREGNANCY

BY M. PIERCE RUCKER, M.D., AND L. J. WHITEHEAD, M.D.

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THE question as to whether the roentgen ray can help in the diagnosis of an extrauterine pregnancy has been variously answered in recent literature. Edling[3] says that his experience does not indicate that the roentgen ray can distinguish between an intra- and an extra-uterine pregnancy. On the other hand, Peterson[6] says that pneumoperitoneum and the roentgen ray are invaluable in the diagnosis of unruptured tubal pregnancy. However, on a recent visit to Peterson's clinic, we were told that they rarely do a pneumoperitoneum now. A number of cases of advanced abdominal pregnancy in which the roentgen ray was useful in the diagnosis have been reported by Viallet and Jahier,[10] Schockaert,[5] Jaroschka,[4] Chamba,[2] and Candy.[1] In these cases the shadow of the fetal skeleton proved the nature of the abdominal mass. That it was extrauterine was proven in some of these cases by visualizing the uterine cavity with contrast fluid.

However, it is early in the course of extrauterine pregnancy that we have our greatest diagnostic problem, and it is then that any additional help is indeed welcomed. Schneider and Eisler[7] say that the actual visualizing of the tubal pregnancy by injection of lipiodol is too much to hope for, but that hysterosalpingography gives valuable indirect evidence of a tubal pregnancy. First, the uterus is apt to show a rounded or globular form due to a "pregnancy atony," without the filling defect that would indicate the intra-uterine presence of the ovum. Secondly, the affected tube would show one of eight forms of total or partial occlusion. The tube may be occluded completely at either the uterine end or the fimbriated extremity. Schneider and Eisler give diagrams of the possible shadows that might be found if the contrast oil did enter the tube. The most characteristic picture is where the oil forms little islands along the course of the tube or else sifts in fine droplets out of a clubbed extremity. In other words, a globular uterine cavity with one patent tube and the other showing one of the filling defects enumerated is strongly suggestive of a tubal pregnancy. They report a case that had a uterine atony with a dilated, completely closed fimbriated extremity, which they considered highly suggestive of tubal pregnancy, and which at operation proved to be a pus tube and a recent abortion. We have had one such case. This patient was first seen at the prenatal clinic where she was considered to have an early uterine pregnancy. Several weeks later she entered the Memorial Hospital with fever and uterine bleeding. The fever disappeared and the bleeding stopped in the course of a week. Vaginal examination then disclosed a soft anteflexed uterus about the size of a two months' pregnancy and a somewhat larger globular mass to the left. Hysterosalpingograms showed an atonic uterine shadow and a closed, clubbed left tube. At operation a tubo-ovarian abscess was found, which most likely was a postabortal one. On the other hand, Jungmann[5] shows hysterosalpingograms of a tubal pregnancy, confirmed at operation, with a triangular uterine shadow and a globular enlargement of one tube near its fimbriated extremity.

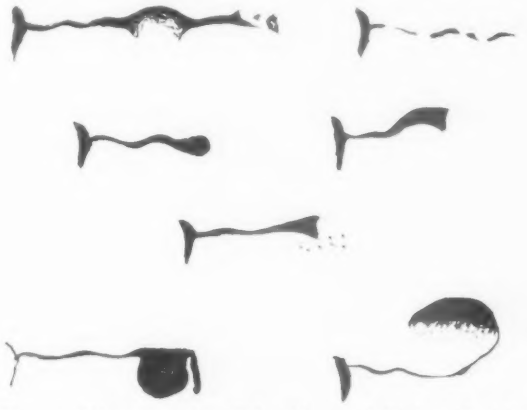

FIG. 1. Diagram after Schneider and Eisler, showing possible filling defects of the tube in tubal pregnancy.

FIG. 2. Hysterosalpingogram of a case of tubo-ovarian abscess showing uterine atony and a dilatation and obstruction at fimbriated end, suggestive of ectopic pregnancy.

FIG. 3. Hysterosalpingogram of ectopic pregnancy. Note the length of the cervix. The tenaculum is on the anterior lip. The uterus is pushed to right and anteriorly. It is enlarged and shows curious filling defects.

In speaking of hysterosalpingography, Schultze[9] says that we are at the beginning of a new chapter in diagnosis, and that a number of factors enter into our interpretation of these fascinating pictures. It is only after many provings that we can arrive at confidence in diagnosis. It is for that reason that we report the following case.

CASE REPORT

Mrs. N., aged twenty-seven, consulted one of us believing that she was pregnant on account of nausea, weakness, and nervousness. Her only child is four years old. Previously there had been an abortion. Her last menses was one week late and lasted ten days (Feb. 16–26). Examination on March 7 showed what was taken to be a tender retroverted uterus that filled the pelvis. The cervix was pushed up to a position just back of the upper border of the symphysis pubis. She had had some severe abdominal cramps and pains in her rectum, but no shock. Red blood cells, 4,000,000; leucocytes, 5,500; hemoglobin 75 per cent. Under ethylene anesthesia, a vain attempt was made to correct the position of the uterus. The uterus was then explored and was found to be empty. We then waited for uterine bleeding to stop and injected the uterine cavity with lipiodol. The roentgenograms show an elong-

FIG. 4. The same case in the Sims' position, showing atonic cavity and many filling defects and a patent right tube.

gated cervix and an enlarged atonic uterine cavity that is directed forward and to the right. The uterus shows many irregular filling defects, giving it a very irregular contour. The right tube filled well, but no oil entered the left one. Operative findings (Drs. Willis and Johns) were a ruptured left tube, a firm retro-uterine blood clot, and a normal uterus. The filling defects in the uterus were evidently due to adherent blood clots.

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ROENTGEN STUDIES OF THE BONES IN CERTAIN DISEASES OF THE BLOOD AND HEMATOPOIETIC SYSTEM

BY ROLLA G. KARSHNER, M.D.

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THE occurrence at the Children's Hospital during the past year of several cases in which roentgenograms of the bones have made or materially aided the diagnosis of certain disturbances of the blood has provoked this paper. Roentgen bone changes are not common in anemias and allied diseases, but when they do occur are often striking and of material aid in differential diagnosis.

ANEMIA

The anemias may be classified as those due to blood loss, those due to defective blood formation, and those associated with increased blood destruction. These classes may be further subdivided into many types, in all of which there are changes in the bone marrow, but which are not by any means all demonstrable on the roentgenogram. A certain few anemias, however, not infrequently give characteristic roentgen pictures.

Myelophthisic anemia is a type dependent upon a crowding out of normal marrow tissue by infiltration or tumor. In such case the liver and spleen may show active hematopoiesis, and the activity of the remaining marrow cells becomes increased to a varying degree, not always proportional to the amount of infiltration, suggesting that often some additional irritative process plays a part. This type of anemia can therefore arise from a various number of conditions. Crowding out of the erythrogenic centers by hyperplastic marrow is an integral part of myelogenous leucemia. To a less extent it obtains in lymphatic leucemia. The term covers all types of osteosclerosis, multiple myeloma, chloroma, lymphoma and metastatic tumors from hypernephroma and carcinoma. It embraces the type of anemia occurring in Hodgkin's disease, in which bone lesions demonstrable by the roentgen ray are not uncommon, appearing as a granulomatous periostitis accompanied at times by osteophyte formation, or as rarefaction of bone with pathological fracture simulating the picture of metastatic malignancy. [2,4,8,18,26]

The term osteosclerotic anemia attaches to a secondary anemia due to destruction of the bone marrow by malignant metastases in which abnormal and immature erythrocytes and myeloid leucocytes appear in the circulation and there is an extreme myeloid reaction of the spleen resulting in splenic tumor.[24] This type, regarded by pathologists as an entity, is, of course, clinically a myelophthisic anemia. To the roentgenologist, it may manifest itself either as an osteoplastic process or by osteoclasis. However, it should not be forgotten that there may be generalized malignant metastases within the bones with neither osteoplastic nor osteoclastic change.[27]

A specific type of anemia falling within the myelophthisic group occurs in osteopetrosis (marble bones), of which I reported 4 cases two years ago.[16] In this disease there is an extraordinary thickness of cortical bone at the expense of the medulla, giving rise to a diversity of secondary characteristics among which are anemia, leucemic states, and spontaneous fractures. I have since seen a fifth case of this condition in a woman of middle age, presenting a fracture of the sacrum from trivial injury which healed in the usual time. For years she had suffered from a stubborn, severe secondary anemia of unknown cause, her hemoglobin hovering around 40 per cent.

von Jaksch's anemia

Von Jaksch's anemia, anemia infantum pseudoleucemica, a doubtful clinical entity, is the most easily recognized of all the chronic forms of splenomegaly. Beginning before the end of the second year of life, its course is slow. The spleen is large, hard, rounded, smooth, not tender. The disease differs from other types of splenic anemia in that it presents a considerable leucocytosis with relatively high lymphocyte count. It is said to do well following splenectomy. Cooley, Witwer and Lee[5] have recently collected 7 cases of anemia in children which resembled that of von Jaksch, distinguished however by mongoloid facies, due to a muddy, yellowish discoloration of the skin and a thickening of the cranial bones and malar eminences. These patients also presented very striking roentgen changes in all the bones. I have reviewed recent roentgenograms of Case v of their series, now a patient at the Los Angeles General Hospital. I have also studied for more than a year at the Children's Hospital two brothers of Italian parentage, aged four and ten years respectively, presenting clinical and roentgenographic findings identical with those in the above child. The younger of them has come to autopsy and will be reported in detail elsewhere.

In the roentgenograms of these patients there is a decided thickening of the medullary portion of the cranial bones, with unusually thin inner and outer tables. In the early stages the marrow is mottled and spongy. In the later stages a second change enters the picture in the nature of new bone formation, showing as striations perpendicular to the tables. The pelvis, spine, ribs, scapulae and bones of the hands and feet are very porous. The metacarpals are expanded. The cortex of the long bones is very thin. The medulla is unusually transparent, and within it the trabeculations are sharp and finely penciled with large interspaces. The changes are greatest in the metaphyses, the disease affecting all the bones of the body. The bone changes are evidently a reaction of the marrow to prolonged overstimulation beginning in the cranium before the cortex is firm enough to prevent overgrowth. The striations which later appear in the skull suggest replacement of exhausted marrow by bone. Spontaneous fractures have not occurred. None of the cases has shown periosteal or joint involvement.

Gaucher's disease

Gaucher's disease is a rare form of splenomegaly of slow progression, associated with a moderate amount of anemia and characterized by the presence of the Gaucher cell.[30] Beginning in childhood or earlier, the enlargement of the spleen may for years be the only symptom. Then an anemia with leucopenia develops, and the liver enlarges. The skin becomes icteric and there is a gradual loss of weight, death ensuing from exhaustion or intercurrent infection. Splenectomy has been performed with varying reported results.

The classic monograph of Pick[22] in which

he regards this condition as a skeletal disease has placed the subject in a new light. He believes that in the past many cases of skeletal involvement have been undiagnosed. He cites two adults in whom generalized bony involvement was verified at autopsy. In one instance there was kyphosis. Pick further mentions similar findings at autopsy in the case of Zadek,[31] a forty-one year old man with an ununited fracture of the forearm following trivial injury. He reports the case of Howland and Rich, a girl of twelve, who had undergone splenectomy at eighteen months of age. Autopsy showed the liver, lymph nodes and bone marrow filled with Gaucher cells. The long bones were expanded with very thin cortex. There was a healed fracture of the femur. The pelvis and spine were infiltrated and there was lumbar kyphosis due to compression of the bodies of the vertebrae. The spinal canal was invaded. Roentgen findings are not reported in any of the foregoing cases.

In 1926 Cushing and Stout[6] collected 47 cases of Gaucher's disease from the literature and added 2 of their own. In 2 of the 47 cases there had been pathological fractures of the long bones without microscopic or roentgen examination. The second case reported by these authors, a woman aged thirty-three, gave a history of pain and limited motion in the right hip for three and a half years. There was shortening, and a roentgenogram showed some destruction of the head of the femur which progressed and involved the neck as well as the acetabulum. Diagnosis was confirmed by splenectomy. Her condition improved. Later the head and neck of the femur were resected and sequestra were removed from the acetabulum. The capsule of the joint was greatly thickened and scarred. There was no synovial membrane, the neck of the femur was soft, the bones sandy and granular in consistency and could be cut with a knife. Very little articular cartilage remained on the head. Microscopically the marrow spaces were loaded with Gaucher cells. Roentgen-ray examination eight months subsequently showed rarefaction in the lower part of the femur and about the acetabulum. Santee[25] reports a male of twenty-nine in whom diagnosis was verified by splenectomy. There was disability of the left hip, the roentgenogram showing rarefaction of the lower portion of the head of the femur, also in the pubic and ischial rami.

Junghagen[14] contributes a study of a girl of three years, whose abdomen had been large since the first week of life. Splenectomy resulted in a diagnosis of Gaucher's disease. Motion of the left hip became limited. Roentgen examination of the entire skeleton showed reduced medullary density contrasting sharply with a thin cortex. The spongiosa was coarse meshed, the trabeculae sharp, the humeri and femora showing the greatest changes. Eight months later there was lumbar kyphosis. Roentgen examination showed the epiphyseal head of the left femur partially destroyed, there remaining a large lateral fragment and a median conglomeration of small fragments suggesting compression. Coxa vara had increased. The joint space was of normal width. The thinning of the shaft of the femur had extended and the pelvis had become involved. The right femur showed periosteal raising. The lumbar vertebrae with the exception of the third were wedged shaped, the interspaces not thinned. There were similar changes in the thoracic vertebrae, most advanced in the sixth and twelfth. Four months later a third roentgen examination showed the destructive process of the left hip to have progressed so that only a small rim of the upper border of the head remained, the joint space still being of normal width. There was more destruction of the thoracic vertebrae, the joint spaces remaining normal.

From material now at hand, the bone changes in Gaucher's disease are distinguishable from those occurring in the special type of von Jaksch's anemia by the presence of destructive lesions, joint involvement and periosteal raising, the occurrence of spontaneous fractures, and the absence of the skull changes characteristic of the latter disease. The destructive process in the hip joint might be indistinguishable from that occurring in flattened head of the so-called Legg-Perthes' type. It should not be confused with tuberculous coxitis. The spinal caries of Gaucher's

disease should be easily distinguishable from those of tuberculosis because the intervertebral spaces remain undisturbed.

LEUCEMIA

Leucemia is now regarded as embracing several states rather than as a single disease picture, these states being consistent in showing histological evidence of leucemic hyperplasia, although clinically and hematologically there may be extreme variations from the generally accepted picture of hyperleucocytosis, enlarged spleen and lymphatic glands. The term therefore not only covers atypical cases of the disease, but conditions frequently classified as tumors, such as chloroma, and various lymphomata.

Bone pain may occur in the leucemias. Patients complain of pressure and throbbing of the sternum in the chronic myelogenous form. Often in chronic lymphatic leucemia there is the same symptom involving all the long bones, particularly the tibiae, marrow proliferation sometimes leading to spontaneous fracture. Bone pain may be so severe as to lead one to suspect osteomyelitis. There may also be swelling of the joints so severe as to simulate acute rheumatic fever. Involvement of the vertebrae may suggest tuberculosis. Pain in the sacral region may be one of the first symptoms of leucemia. The roentgen counterpart of such symptoms may show as periosteal lifting or proliferation, osteosclerosis, small or extensive foci of bone destruction, a moth-eaten appearance of the medulla suggesting decalcification, or as a generalized reduction of bone density scarcely recognizable, or distinguished with difficulty from osteoporosis from other causes. Deafness may be a symptom of leucemia due to changes within the temporal bone, both of the destructive and proliferative type.[12]

Heuck[13] in 1879 described a diffuse osteosclerosis associated with leucemia. There have been reported since more than a dozen such cases, none of which have been roentgenographed.[16] There are various theories as to the causation. The blood disease is probably the cause rather than the consequence of the bone sclerosis. The periosteum is unaffected. Oesterlin,[20] however, records the case of a two year old child with bone pains, severe anemia, myelocytes, splenomegaly, myeloid metaplasia and osteosclerosis, in which the periosteum was a large factor in producing the increased density of the cortical bone. Von Jaksch[29] has reported the case of a female of twenty-four years with bone pains, osteosclerosis of periosteal origin, splenic tumor, and grave myelogenous leucemia.

Taylor[28] presents the roentgen findings in a child two years and ten months of age with chronic lymphatic leucemia. All the long bones, including the metacarpals and metatarsals showed a slight elevation of the periosteum with some productive changes. A section taken from the right tibia at autopsy showed lymphatic infiltrations underneath the periosteum, and replacement of the bone marrow.

Karelitz[15] reports the case of a boy of three years with myeloid leucemia in whom roentgen-ray examination revealed periosteal elevation of the upper third of both tibiae, of the lower third of the right humerus, and of the bones of both forearms. The left radius was widened, and there was some cortical erosion. The right ulna was similarly affected.

A girl, aged five and a half, of Italian parentage, entered the Children's Hospital, Sept. 14, 192-, because of weakness, fever, hemorrhages and glandular enlargement. She had been sick for nine months. Examination showed a poorly nourished, cachectic child, with general adenopathy and multiple marble-sized subcutaneous nodules over the forehead and scalp. Hemoglobin varied from 15 to 40 per cent; red blood cells, 1,000,000 to 2,460,000; white blood cells, 3,250 to 7,600, of which 42 to 78 per cent were small mononuclear lymphocytes. The platelets were diminished. It was reported that earlier in the course of her disease there had been a leucocytosis. She developed bone pains coincident with which changes appeared on the roentgenograms. Death occurred Nov. 7, 192-, autopsy proving the diagnosis of lymphatic leucemia.

Roentgen examination just before death showed a slight porous irregular reduction of bone density of the pelvis, femora, tibiae and phalanges of the hands. To a less extent there were small isolated regions of lessened density in the long bones of the upper extremities. There was periosteal raising along the shafts

of both humeri and both femora, most pronounced over the lower half of the shaft of the left femur, where new bone was laid down perpendicular to the shaft. The reduction of bone density was greatest over the lower thirds of the shafts of the femora, particularly on the left, where the appearance was very moth-eaten. There was irregular reduced density in the neck of each femur adjacent to the epiphyseal line, and a much more definite small destructive lesion involving the proximal metaphysis of the left radius.

Microscopic section through the lower third of the left femur revealed a lymphatic infiltration beneath the periosteum and replacement of bone marrow.

Rolleston and Frankau[23] record the case of a boy aged five, with pain in the back and tenderness over the lower dorsal and upper lumbar vertebrae and also in the left sacroiliac region. Roentgen examination of the spine and pelvis were reported negative. However he was regarded as tuberculous. He then developed the clinical and blood picture of severe acute lymphatic leucemia and died shortly. At autopsy the ribs were thinned, the cancellous spaces large and full of deep red marrow, so brittle that they broke on handling. The cancellous tissue of the bodies of the vertebrae was soft, cut easily, and the compact bone was thinned.

Melchoir's[17] case was similar, a boy of eleven, with severe pain and tenderness over the lumbar spine. Roentgen findings were reported negative. Tuberculosis was suspected and an Albee graft inserted. The patient then developed the picture of acute lymphatic leucemia with death after a total course of five months. At autopsy the vertebrae were externally intact, but much softened by lymphatic infiltration of the marrow.

Pförringer[21] describes the roentgen findings in a case of leucemia with tumor-like overgrowth of the bone marrow leading to spontaneous fracture. Haenisch and Querner[12] record a roentgen study of a case of lymphatic pseudoleucemia in which the skeletal system was involved, with erosion of the vertebrae by tumor. Evans and Leucutia[9] detail 3 cases of lymphosarcoma receiving roentgen therapy, which in their terminal stages changed into lymphatic leucemia coincident with symptoms of bone involvement. In one of these, a male aged twenty-one, there was roentgen evidence of destruction of the shafts of metacarpals and phalanges of the hands with a spontaneous fracture. One tibia and fibula showed small localized destructive areas.

CHLOROMA

Chloroma, formerly classed with the tumors, is now quite generally conceded to be closely related to, if not a form of acute leucemia. The clinical symptoms, blood picture, and pathological findings of the two conditions are frequently identical. The green color of the nodules, tendency to periosteal proliferation and localization about the orbit, formerly considered peculiar to chloroma, are inconstant, and consequently unreliable. Two types of chloroma are described, the myelogenous or myeloid, and the lymphatic or lymphoid.

Gould and LeWald[11] found in a girl of three and a half years a wide separation of the cranial sutures. In another case, a boy of five years, there was separation of the suture lines and in the humeri and femora laying down of bone along the periosteum parallel to the shaft, with a peculiar rarefaction of the medulla. Allison[1] reports the roentgen findings in a girl aged three complaining of painful joints, headaches, swelling about the eyes, and presenting multiple pea to olive sized nodules over the parietal and occipital regions. There was a slight separation of the coronal suture, no changes in the joints or epiphyses, with, however, an extensive proliferative periostitis involving the shafts of the long bones. Most of the new bone was laid down parallel to the shaft. Near the epiphyseal ends, however, much was at right angles to the shaft. None of the foregoing cases were proven at autopsy. In this connection the case of Karelitz[13] is interesting, a boy of two and a half years with a clinical and roentgenological picture of chloroma, which at autopsy proved to be one of neuroblastoma with metastases. There was fever, severe secondary anemia, myelocytes, exophthalmos, enlargement of the head, bone pains, lymphadenitis, splenomegaly, nodules over the head, hemorrhagic tendencies, separation of cranial sutures and periosteal elevation.

I have examined an instance of chloroma in a child of three years presenting swelling about the orbit. She passed from observation, autopsy some time later confirming the diagnosis. The only positive roentgen finding was widening of the cranial sutures, the long bones being negative.

The fundamental similarity of the roentgen picture of chloroma to certain cases of leucemia is impressive, and furnishes roentgen evidence to substantiate clinical and pathological evidence of their identity.

The periosteal changes in the leucemias including chloroma, must be differentiated from those of lues, fractures, trauma without fractures, osteomyelitis, tuberculosis, typhoid, leprosy, yaws, coccidioidal granuloma, pulmonary osteoarthropathy, osteitis deformans, rickets, scurvy, Hodgkin's disease and the proliferative type of bone tumors.[10]

HEMOPHILIA

Hemophilia is a hereditary abnormality of the blood or blood-forming organs affecting males, transmitted solely by females, and characterized by a deficiency of prothrombin, causing delayed coagulation and liability to immoderate or fatal hemorrhage.

The roentgen changes in this disease are the result of hemorrhage into the joints and adjacent bone, and may be divided into two groups, those of early cases without destructive changes, and those of advanced cases showing destruction.[7] Any joint may be involved, most commonly the knees, elbows, ankles, hips and shoulders. In the early stage there may be effusion of blood into the joints, which may or may not show calcification. The joint capsule may be thickened, and there may be lipping similar to that of hypertrophic arthritis. This stage without calcification from previous hemorrhage might be very difficult to distinguish from the picture of chronic infectious arthritis. Instances are on record in which there have been many hemorrhages into the joint without residua. However, repeated hemarthrosis not infrequently leads to the findings of the second group manifested by general or localized cartilaginous destruction, various forms of bone destruction, which may show as punched out areas in the epiphysis with an intact articular surface, or destruction of the articular surface, often with localized rounded destructive areas extending into the epiphysis. Frequently a blood clot in the synovial cavity becomes organized and more or less calcified. This latter, when associated with punched out areas of destruction, either with or without arthritic changes, serves to differentiate the roentgen appearance of hemophilia from that of gout. Tuberculosis is excluded by the clearness of outline of the articular surfaces, the peculiar punched out areas of bone destruction, and evidence of organization of the fluid within the joint.

PURPURA

Purpura hemorrhagica is characterized by hemorrhage from the mucous membranes, petechiae, or ecchymoses of the skin, reduced platelet count, prolonged bleeding time, and a non-retractile clot. It may occur as a symptom in the anemias and leucemias. Conceivably it could show roentgen evidence of hemorrhage, but careful roentgen examination of many patients with this disease has failed to show any such evidence in my hands and I can find no instance in the literature. All the other types of purpura may be classed together in that there are no demonstrable blood changes, the fault seeming to lie in an increased permeability of the walls of the small blood vessels to the blood constituents, both serum and cell. The symptoms cover a wide range of variability, certain common combinations appearing fashionably as Henoch's purpura, or purpura abdominalis; and purpura rheumatica, or Schönlein's purpura. Particularly in the latter, serous exudate into joints causes arthralgia and often simulates arthritis, recurrent attacks leading to actual tissue reactions with resulting chronic arthritis, as in hemophilia.[3]

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OSSEOUS CHANGES IN HEMOLYTIC ICTERUS

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DEVIATIONS from the normal roentgenographic appearance of osseous tissue is invariably associated with a pathological morphology. The cause for such changes may be local, such as osteomyelitis, or osteolysis as the result of an invading neoplasm, etc.; prodromal manifestations as observed in rickets, scurvy, congenital lues, osteomalacia, Paget's disease, fragilitas ossium, osteitis fibrosa, etc.

That some types of anemia in children may cause changes in distant organs is stated by Brannan[1] in his description of extramedullary hematopoiesis. In his series, blood-forming growths were observed in hila of the kidneys, falx cerebri, thymus, lymph nodes, and other organs. Similar blood-forming cells were found microscopically in non-anemic infants.

The *osseous* changes observed roentgenologically are a result of extramedullary erythropoiesis, and while the latter condition may be present in all forms of anemia, the *roentgen* evidences are quite definite only in the entity known as *hemolytic icterus*, of which at least two types are described—the congenital and the acquired.

Roentgenograms reveal changes in the skull and long bones. The skull changes differ from those observed as a result of rickets in that the diploë in the latter malady casts a more homogeneous shadow on the roentgen film. There is a definite pathological basis for these changes, which may be described as follows: The osteoid tissue calcifies early in rickets, resulting in abnormal thickness and density, whereas the thickening of the parietal and frontal bones in hemolytic icterus progresses at the expense of the diploë which appears vacuolated. The premature suture synostosis explains the unusual thinness of the skull at the coronal and lambdoid sutures.

The long bones show striae parallel with the long axis of the shafts. The cortex is intact but thin. "Moth-eaten" areas are observed measuring from 1 to 2 mm. in diameter. The osseous atrophy, when due to other causes, differs from the hemolytic type by the absence of the small rarefied areas and striae. This difference may be readily gleaned from the accompanying illustrations.

The physiognomy in the series observed by the author corresponded with that described by Cooley et al,[2] namely, the outstanding mongoloid features. These children, however, exhibited normal intelligence for their respective ages.

The classification of mongoloid is made significantly, because there is not the characteristic slanting palpebral fissue and forehead of the Mongolian idiot. While some characteristics of the cretin may be evident, the facial expression precludes the possibility of error. "The prognathia of the superior maxilla in the cretin is the result of retarded development of the base of the skull, enlargement of the tongue, and delay in cutting teeth."[3] The latter two factors do not enter into the abnormal facial development of the hemolytic victim.

CASE REPORTS

Case 1. C. Z., female, aged thirteen, Italian, born in the United States, admitted to Bellevue Hospital on July 27, 1927, with the diagnosis of lymphosarcoma. Father and mother, two sisters and one brother living and well. Had pertussis when eighteen months old, and at the same time the abdomen appeared to enlarge on the left side. There was no pain.

Urine appeared dark colored and many glands became palpably large. The history for several years prior to admission appears to be vague.

Physical Examination. Undersized, moderately emaciated female, appearing much older than stated age. Features were mongoloid, skin jaundiced, mentally alert and normal for her age. Heart slightly enlarged and a fine systolic murmur was heard at the base,—not transmitted. The abdomen was generally prominent, marked on the left side, where a large spleen was palpable. The lymph nodes were also palpable in inguinal and axillary regions. The biopsy (#5406) of a node removed

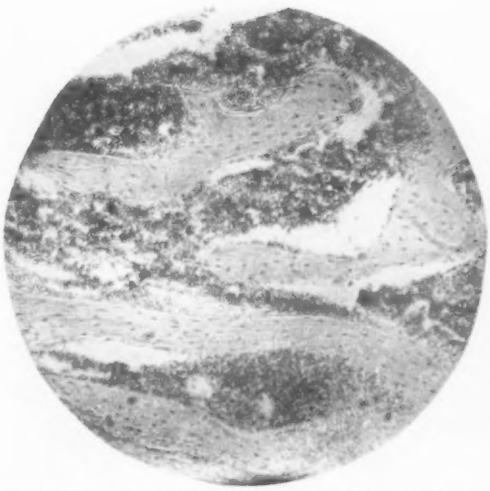

Fig. 1A. Section of normal rib from a child aged five.

Fig. 1B. Section of rib from Case IV showing, besides the abnormal cell elements, peculiar arrangement of the bone lamellae as compared with Figure 1A. (Low power.)

from the inguinal region revealed hyperplastic lymphoid tissue. The breasts were undeveloped; genitals appeared normal; has not menstruated. Cytological examination on Sept. 20, 1927: Red blood cells, 2,560,000; leucocytes, 25,000; hemoglobin, 28 per cent. Nucleated red cells present; fragility, marked.

High voltage roentgen-ray therapy to the spleen and mediastinum has had no appreciable effect on the progress of the disease, nor has any change resulted in the bone picture.

Case II. M. S., female, aged six, of Italian

Fig. 2A. Skull of a child with rickets.

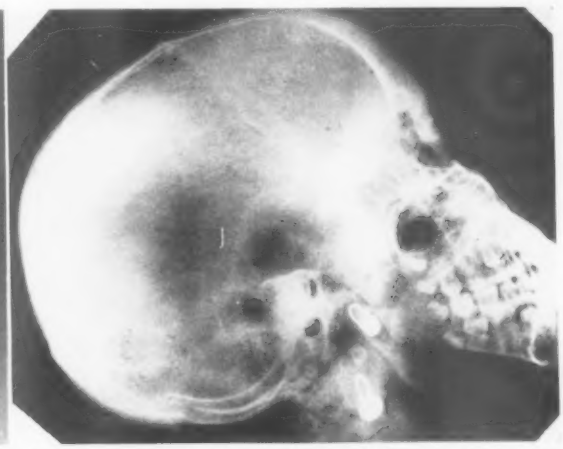

Fig. 2B. Skull of Case I. Notice difference in texture.

Roentgen examination revealed the following: The skull was moderately large in size, the maximum anteroposterior diameter being 19.5 cm. The frontal and parietal bones were considerably thickened, the maximum being 11 mm. The tables remained thin, but the diploë were markedly widened and mottled with minute rarefied areas. The bones of the forearms and hands revealed a pseudoatrophic appearance with numerous small areas of rarefaction and striations (see Fig. 4B).

extraction, born in the United States. Was admitted to Bellevue Hospital on Aug. 23, 1927. The present illness began two years ago; has always been pale and undersized. She was splenectomized in 1926 for a condition diagnosed then as hemolytic jaundice.

Physical Examination. Slightly undersized and undernourished female. Her head appeared rachitic, with prominent bosses. Fontanelles closed; pupils regular; sclera had an icteric tint; mucosa pale.

Fig. 3A. Fig. 3B. Fig. 3C.

Fig. 3A. Roentgenogram showing apparently normal bone in a case of pernicious anemia of long duration
Fig. 3B. Showing marked atrophy as a result of arthritis.
Fig. 3C. Forearm and hand of Case III. Note striations and small rarefied areas.

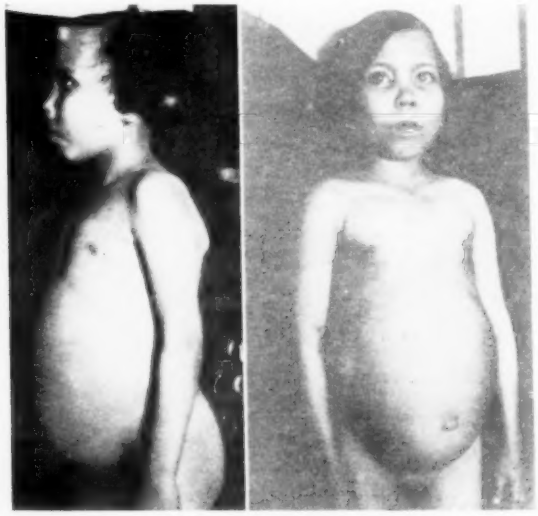

Fig. 4A. Case I. Note characteristic mongoloid features and protuberant abdomen.

Fig. 4B. Note "moth-eaten" appearance and striations of radius, ulna and bones of hand.

Heart. Cardiac apex heard in the fifth interspace within the mammary line. The action was rapid, sounds snappy, and a loud blowing systolic murmur was heard over the entire praecordium. There was reduplication of the second sound at the apex ($P^2 > A^2$).

Abdomen. Laparotomy scar in the left upper quadrant. The liver was not palpable. The genitals were normal.

A composite report of several cytological examinations made between May 25, and October 14, 192-, revealed the following average count: Red blood cells, 2,500,000; leucocytes, 20,000; hemoglobin, 40 per cent;

Fig. 5A. Case II. Note mongoloid features and splenectomy incision.

moderate number of nucleated red cells; platelets, 313,000.

indirect, 2+; fragility observed at 0.475 per cent (Sanford's method).

Roentgen Examination. The skull and osseous changes were characteristic, and similar to the description in Case I (see Fig. 5B).

Case III. L. V., male, aged seven, of Italian parents, admitted to Bellevue Hospital, January, 1928. Illness has developed insidiously during the past three months with reddish discoloration of the urine, later malaise, easily fatigued, headaches, and paleness. On admission, he appeared slightly ill and jaundiced. Cervical lymph nodes were enlarged; the liver extended 4 cm. below costal margin. Spleen was palpable down to the iliac crest. Heart enlarged; blowing systolic murmur at the apex.

Cytology: Red blood cells, 3,580,000; leucocytes, 7,200; hemoglobin, 40 per cent; polymorphonuclears, 50 per cent; small lymphocytes, 36 per cent; transitionals, 5 per cent; platelets, 100,000; poikilocytosis, anisocytosis.

Blood chemistry: Non-protein nitrogen, 33; uric acid, 1.5; chlorides, 0.595; phosphorus, 4.0; icteric index, 15; van den Bergh—direct, 0; indirect, 2+; bleeding time, one minute forty seconds; clotting time, 2.5 minutes; cell volume, 31; fragility, 0.575 per cent.

Roentgen examination of head and extremities revealed conditions as described in Case I.

Case IV. M. V. (sister of Case III), aged four and a half, of Italian parentage, admitted to Bellevue Hospital, Dec. 20, 1927. She died two days later.

Previous History. She walked and talked

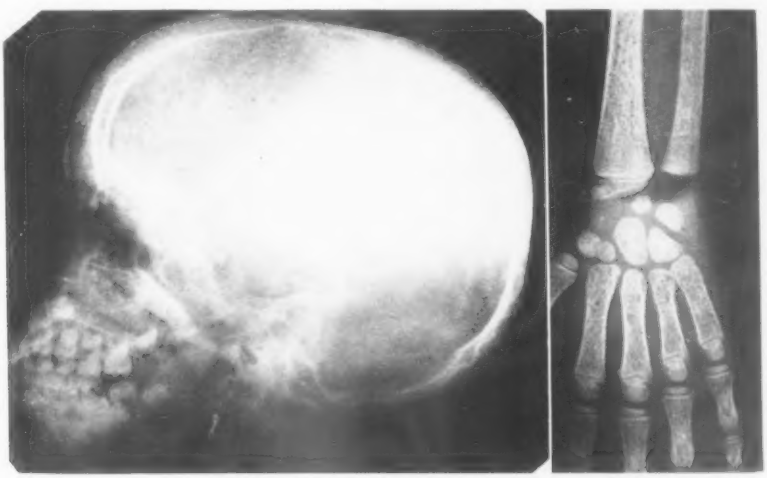

Fig. 5B. Fig. 5C.

Fig. 5B. Roentgenogram of skull.
Fig. 5C. Note peculiar texture of bones of forearm and hand.

Blood Chemistry. The bleeding time was five minutes, clotting time two minutes; icteric index, 20; van den Bergh direct, 0;

at the age of sixteen months. Palor and slight jaundice began at one year. Admitted to Bellevue Hospital in December, 1926, with marked

jaundice, fever, and cloudy reddish urine, splenomegaly. Splenectomy done. Slightly improved.

Present History. Recurrence of fever and jaundice; edema of face and ankles; skin of deep lemon yellow.

Physical Examination. Heart enlarged to left, moderate loud blowing systolic murmur over praecordium; liver palpable below costal margin. Conjunctiva and sclera jaundiced.

Cytological examination made during January and February of 1927 showed the following average results: Red blood cells, 3,666,000; leucocytes, 11,000; hemoglobin, 66 per cent; moderate pallor; large number of normoblasts; megaloblasts; anisocytosis; slight poikilocytosis; icteric index, 22; van den Bergh—direct, 0; indirect, 1+ to 4+; fragility—0.5 - 0.575 per cent. No roentgen examination was made.

Necropsy Report (Dr. M. N. Richter). Anatomical Diagnosis: Secondary anemia, with jaundice and lymphadenopathy; absence of spleen.

The body is that of a white female child, about four years of age, 40 inches in length and weighing about 45 pounds. The muscular development is normal; body in fairly good nutrition. Rigor mortis is absent; slight postmortem lividity present. The skin is smooth, normal in texture, and slightly jaundiced. There is a left rectus abdominal incision about 4 inches in length, mucous membranes are pale. On section, the muscles are deep red, fat about normal in amount and color. The peritoneum is smooth and glistening and contains only a few cubic centimeters of clear fluid.

The pleural and pericardial cavities are normal.

Lungs. Normal in size and color, crepitation very slightly diminished; pleural surfaces smooth and glistening.

Heart. Slightly dilated, filled with chicken fat clot. All valves are normal; musculature natural. On the pericardial surface, and following the coronary vessels, are a few white nodules about 0.5 mm. in diameter.

The thyroid is normal.

The thymus is enlarged and glandular.

Liver. Normal in size, deep in color, and on section, appears normal in structure.

Gastrointestinal tract is normal throughout.

Adrenals. Natural.

Kidneys. Normal in size. On section, the markings are preserved, but the kidney substance is pale.

Lymph Nodes. Enlarged, most noticeably in the mesentery, para-aortic and iliac chains. The nodes vary in size, the largest being about 1 cm. in diameter. Most of them are pink, some deep red.

Uterus, ovaries, tubes, and broad ligaments are normal.

Brain. Normal. Pituitary gland normal.

Bones. The cranium is thicker than normal, but not uniformly so. At the sutures, between the parietal and temporal bones, the skull is very thin; depressions corresponding to the cerebral convolutions are very marked.

The bone marrow is markedly hyperplastic and deep red.

There is no fatty marrow in the femur, sternum, ribs, and skull; it is entirely replaced by red marrow.

SUMMARY AND CONCLUSIONS

Four cases of hemolytic icterus are presented.

Only sufficient data are given to identify them as belonging to this group. A résumé of the prodromal features definitely characteristic are as follows: Insidious onset, chronicity, jaundice, splenomegaly, anemia, leucocytosis, atypical red cells, high icteric index, marked fragility, urobilinuria, *osseous changes*, and mongoloid facies.

The possibility that they were all congenital must be seriously considered. It is reasonable to assume that the crises were extremely mild during infancy and were therefore, unnoticed. *It is certain that the cranial and facial changes are more consistent with the congenital nature of this ailment and are definitely pathognomonic.*

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TECHNICAL METHODS OF RADIUM APPLICATION IN RECTAL CANCER*

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RADIUM therapy has been employed in cancer of the rectum for more than ten years. The favorable results of Quick[1] in 1921, and Kelly and Ward[2] in 1922 were a great stimulus to this method of treatment. Since the publication of these reports there has been considerable improvement in the dosage and methods of application. The earlier methods consisted in applying small amounts of radium to the surface of the tumor, and larger amounts at a distance from the skin; small glass emanation seeds, radium element or large filtered emanation needles were also implanted into the tumor. In some instances only one form of application was used, but the majority of workers obtained the best results by a combination of two or more of the above forms of application.

The results of these earlier methods of treatment were often gratifying, as clinical cures and valuable palliation were brought about. However, on account of the severe reaction and the numerous unexpected failures, these methods of application were soon considered insufficient for routine use. The small unfiltered emanation seeds were undoubtedly of greatest value, as they provided the most adequate irradiation of the malignant cells, but the reaction which followed this form of treatment was usually too severe. When cases were improperly selected or large doses employed, the effects of treatment were at times worse than the original disease. In other words, the glass seeds were capable of producing good results in selected patients who were able to withstand the accompanying reaction.

Adequate irradiation of a rectal cancer with large needles was found to be more difficult than with emanation seeds, on account of the irregular shape and inaccessibility of the tumor. The two main obstacles to this form of application were the proper placing and retention of these bulky needles within the tumor mass. Reaction following this method was equally as severe as that following the use of glass seeds.

Surface applicators and tubes arranged in tandem were widely employed for a time. The popularity of these surface applicators was due to the simplicity of application rather than to the results obtained. Because of the thickness and irregular shape of the tumor only a certain degree of palliation was produced in the average case, while surface destruction of the tumor and inflammatory reaction due to the irradiated normal mucosa always produced a very distressing train of symptoms.

Although for the past three years we have discontinued the use of glass seeds, large needles and surface applicators, external irradiation has been employed with increasing intensity. Experience has proven that this form of application is valuable both when used alone and in combination with implantations of heavily filtered emanation seeds.

The majority of rectal cancers are columnar cell in type but a small percentage which originate in the anal canal are of the squamous variety. Despite the ease with which an early diagnosis is usually possible, the majority of these tumors have usually attained a considerable size before the patients are referred for treatment.

The type of radium applications suitable for rectal tumors must be capable of exerting a satisfactory influence when applied to tumors of a similar size and shape in more accessible locations of the body. Moreover, these applications must lend themselves to uniform adequate irradiation of all malignant cells in these inaccessible tumors, and at the same time must not produce undue reaction. External irradia-

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tion, by radium and roentgen rays, combined with the implantation of heavily filtered gold emanation seeds, are the two methods of application which come nearest to the ideal requirements.

Radium possesses curative as well as palliative powers. However, it must not be considered a panacea for all stages and types of disease; nor should radium therapy be considered the only method of treatment. Undoubtedly the most favorable results in a miscellaneous group of rectal cancers are obtained when an unbiased choice or combined use of both radium and surgery is adopted. On account of the variations in the general condition of patients, location of lesions, extent of disease and the degree of malignancy and radiosensitivity of the cancer cells, there is no routine method of treating rectal cancer; nor is there any routine dose of radium applicable in all cases, because the radiosensitivity of these tumors varies widely. Therefore, each patient must be considered as an individual problem and the treatment provided in accordance with the clinical and pathological aspects of the particular case.

However, from the standpoint of treatment, patients with cancer of the rectum may be divided into favorable and unfavorable groups. Clinical cures are expected in the favorable cases, while the unfavorable group is provided with varying degrees of palliation. The favorable group may be subdivided into: (1) patients in whom radiation therapy alone is sufficient to produce the desired result; (2) patients who require a colostomy in addition to radiation therapy; (3) patients in whom radiation therapy combined with radical surgery offers the greatest possibilities. The unfavorable group is subdivided as follows: (1) cases suitable for intensive palliative procedures; (2) cases suitable for mild palliative treatment; (3) cases which, because of the advanced stage of the disease or poor general condition, are unsuitable for treatment.

The technique of radium applications in the favorable and the unfavorable groups is similar, but the intensity of such applications varies widely. The favorable case receives, within a period of a few weeks, radium applications of sufficient intensity to alleviate the condition; while the unfavorable case is given preliminary treatment of only sufficient intensity to restrain the growth activity. These palliative doses, which are repeated as the occasion demands, may be continued over a period of years.

EXTERNAL APPLICATIONS OF RADIUM

When adequate, external irradiation is the ideal method of radium therapy. This form of application influences not only the tumor mass but also a large area of the surrounding lymph nodes which may be involved. While providing rather intensive and uniform distribution of the rays to the irregularly shaped and inaccessible tumors, it never produces trauma nor introduces infection into the tumor mass. The constitutional reaction following external application is seldom more than a slight feeling of malaise, provided the general condition of the patient is good and the colon is not filled with fecal material. The local reaction is manifest by a slight increase in mucus discharge which however soon decreases in amount and loses its blood-stained character. Unfortunately, we have so far had only 2 cases of columnar cell carcinoma of the rectum which were sufficiently radiosensitive to disappear by this form of application. Nevertheless external irradiation is a real adjunct to the implantation of gold seeds in the more radioresistant group. In this group, rather intensive external application will determine the radiosensitivity of the tumor and decrease the area of superficial ulceration. Furthermore, it allows a more accurate determination of the limits of the mass, as the inflammatory characteristics will often disappear. These favorable effects allow for a more accurate calculation of the dose and provide a more suitable field for implantation.

The most serviceable applications of external irradiation are provided by comparatively large amounts of radium element or emanation in the form of a pack or large applicators. Our element pack contains 4 grams of radium. There is sufficient lateral screening to prevent undue body irradiation, while the filter at the portal of

exit is 0.35 mm. of platinum and 1.50 mm. of brass. The emanation pack contains about 2000 mc. of radium emanation and is filtered by 0.50 mm. of silver and 1.50 mm. of brass. Either form of applicator may be employed, but only one area is treated at a time. The pack is applied at 10 or 15 cm. from the skin at suitable areas about the pelvis. Three portals of entry are usually employed, in the midline: a posterior field over the sacrum, an anterior field over the pubis and lower abdomen, and a perineal portal, when the tumor is situated near the anal canal. More intensive irradiation is possible by employing five fields, namely: right and left anterior, right and left posterior, and a perineal field. When a larger amount of external irradiation is considered advisable, right and left lateral fields add a small additional dose. Care must be taken to prevent overlapping of fields. When sufficient radium is not available for external treatments high voltage roentgen radiation may be substituted. Theoretically, a similar effect is exerted by these two different rays, but the clinical effect that follows the employment of the gamma ray appears to be superior to that of the roentgen ray.

EXTERNAL IRRADIATION IN THE FAVORABLE GROUP

The first step in therapy of tumors constituting the favorable group is external irradiation. The efficiency of this method depends primarily upon the radiosensitivity of the cancer and the intensity of treatment. Intensity of irradiation of the tumor mass is influenced by the size of the pelvis, the number of portals employed, the dose administered over each portal and the interval between applications. The tolerance of the skin determines the maximum surface dose of external irradiation at each portal. A pelvic cycle of external treatment employing from two to five portals of entry is usually completed within two or three weeks. The dose of the pack when used at 10 cm. from the skin is 20,000 to 22,000 mc-hr. at each portal. This dose may be given at one time or divided into two applications. The dose of 20,000 mc-hr. may be repeated, at another portal, after an interval of a day or two. When the pack is employed at 15 cm. from the skin, the tumor will receive a larger proportion of the skin dose, but larger applications are required. We have been administering 50,000 to 60,000 mc-hr. at 15 cm. at each portal in the form of daily applications of 4,000 to 12,000 mc-hr. each. The maximum dose, at 15 cm. distance, that we have given any one patient has been 200,000 mc-hr. In addition to the above "pack" doses, one can usually employ high voltage roentgen rays of the following intensity: 240 to 300 ma-min.; spark gap 14 cm.; filter 0.5 mm. of copper and 2 mm. of aluminum, with a focal distance of 50 cm. These roentgen-ray applications are separated by two or three day intervals. A radium and a roentgen-ray application are never given at the same portal on the same day. Seldom is the 15 cm. distance employed for the perineal portal; to facilitate the comfort of the patient we usually employ 20,000 mc-hr. at 10 cm. or an erythema dose of high voltage roentgen rays. Intensive external irradiation is of most value when dealing with the radiosensitive and more malignant types of tumors. When the tumor is of a radioresistant nature and less malignant, smaller doses of external irradiation are usually employed. In the latter instance we must rely chiefly upon interstitial irradiation to care for the primary lesion.

INTERSTITIAL APPLICATIONS OF RADIUM IN THE FAVORABLE GROUP

Interstitial application by gold emanation seeds is the most efficient method of supplying adequate irradiation to radioresistant rectal cancers. This form of application may be used alone. However, we prefer to use preliminary external irradiation and supply the deficiency of dosage at the site of the tumor by implanting gold seeds into the mass. Such applications are usually made within one week following the completion of external treatment. The efficiency of gold seeds is well demonstrated by the favorable results following their employment in intraoral and other accessible tumors. The seeds are 4 mm. long, 0.75 mm. in diameter with a filter of 0.30 mm. of gold and vary in strength from 1 to 3 mc. The filter of 0.30 mm. of gold elimi-

nates about 97 per cent of the soft rays; these seeds therefore supply practically gamma radiation. The elimination of the soft rays greatly enhances the value of emanation seeds in this location. Necrosis of tumor tissue following the first application of filtered seeds is rare unless overdosage is employed or unless the tumor is primarily an infected one. The dose required depends upon the size and radioresistant nature of the tumor. This may vary from 10 mc. (1300 mc-hr.) to 60 mc. (8700 mc-hr.). The shape and thickness of the mass determines the approximate strength of the seeds to be utilized. Usually seeds at 1.50 to 2.50 mc. are most serviceable. Seeds of different strength may be advantageously employed in the same tumor. The object in all favorable cases is to provide uniform irradiation of sufficient amount to devitalize all the malignant cells, without causing the breaking down of the tumor. This is best attained by one application, as secondary implantations are more likely to produce necrosis, sloughing and severe reactions. There is a marked difference between inserting radium into a tumor and supplying adequate irradiation to all local malignant cells. Experience has proven that this form of application is capable of producing good results, but only when a proper application of the seeds is made.

Fig. 1. Proctoscopes 12 to 15 cm. in length with round and oblique openings, suitable for routine examinations.

An appropriate application of gold seeds is facilitated by a detailed knowledge of the pelvic anatomy and familiarity in the use of rectal specula. Visualization of the mass, as to its exact size, shape and extent of infiltration is essential. Palpation through the rectum and vagina determines the size and fixation. Advantage is afforded by proctoscoping the patient in the lithotomy, knee-chest and inverted positions; as often a more complete view of the tumor is obtainable when the patient is in one or another of the above positions. A proctoscope 12 or 15 cm. in length and 2 cm. in diameter is very serviceable for routine examinations (Fig. 1). However, due to the anatomical variations in this region and the size, shape and location of the tumors, specula of varying length and diameter are required. An instrument with an oblique distal opening is also a valuable aid, as it permits

Fig. 2. Straight and fishhook radon needles.

Fig. 3. Sagittal drawing of a patient in the knee-chest posture; seeds being inserted into the distal part of the growth with the fishhook needle.

a better view of certain shaped tumors (Fig. 1). The seeds are implanted by means of long trocar needles. The resistance communicated by these needles offers a means of differentiating normal and malignant tissue. Formerly, only straight needles were employed (Fig. 2). These were found appropriate for the implantation of the lower limits and the bulk of the tumor mass, but they did not allow suitable placing of the seeds at the distal arc of the tumor. Therefore we attempted to overcome this difficulty by devising a needle, as shown in Figure 2, which is somewhat fishhook in shape. This needle may be hooked into the distant limits of the tumor so that the seeds may be deposited as efficiently in the upper as in the lower limits. To expel the seed the plunger is drawn out rather than pushed in, as is the case when the straight needles are used. Our recent experience with these new needles leads us to believe that they afford a marked advantage in the proper distribution of the seeds.

The actual placing of the seeds is guided by direct vision through an electric lighted speculum or by the sense of touch by placing the finger within the rectum. Tumors of the lower rectum, in which the upper limits are easily reached with the finger are suitable for this latter method; whereas those tumors situated in the middle and upper rectum are more satisfactorily reached with the aid of a proctoscope (Fig. 3).

If the implantations are to be guided by the sense of touch a caudal, spinal or general anesthetic is employed. The patient is placed in the position which permits the most adequate distribution of the seeds. The anal canal is slightly dilated; one or two fingers of the left hand are placed within the rectum; the straight or fishhook needles are passed into the lumen of the anal canal and the exact location of their insertion into the rectal mass determined by the finger. At times, more adequate distribution is possible by passing a number of the straight needles into the tumor by way of the posterior vaginal wall, perineum, or posterior commissure (Fig. 4).

The majority of rectal tumors, on account of their location, are more easily treated by direct vision. The patient is placed in the position which from previous examination has been found to be most suitable. Seldom is any form of anesthesia required for this method of application, as the passing of the proctoscope is comparatively painless. Complete relaxation of the pelvic structures is a disadvantage rather than an asset. Although there may be slight pain from the insertion of certain needles, this reaction is valuable as it

Fig. 4. Sagittal drawing showing the finger in the rectum to guide the insertion of the needles. These are being inserted: A—through the anal canal; B—through the posterior vaginal wall, and C—through the posterior commissure.

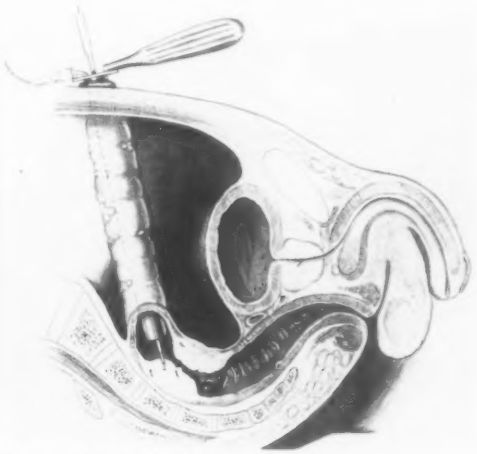

Fig. 5. Sagittal drawing showing proctoscope passed downward through a colostomy opening. Seeds are being inserted into the upper limits of a stenosing tumor with straight needles.

determines to a degree the extent and location of the infiltration. This procedure is painless unless the tumor has infiltrated beyond the rectal wall. When the lumen of the bowel at the site of the tumor is of sufficient size to allow the passage of a suitable proctoscope, the instrument is passed beyond the upper limits of the tumor. It is then withdrawn until the upper limits come plainly into view. At this stage the distal areas are implanted with the seeds by means of the fishhook needles (Fig. 3). The instrument is further withdrawn and another row of seeds is inserted by aid of the straight needles. This procedure of gradually withdrawing the instrument and inserting the seeds is repeated until the tumor mass receives the required number of implants. During the operation a clear field for operation is maintained by suction. In the areas of deep infiltration and increased thickness of the mass a double row of seeds is often necessary in order that the most distant cells may be included in the field of adequate irradiation.

Tumors of a stenosing nature which have practically obliterated the lumen of the bowel cannot be adequately treated with gold seeds unless the patient has a colostomy. However, when the patient has a colostomy, with a short loop of bowel between the opening and the tumor, the upper limits are easily reached by passing a proctoscope downward through the artificial opening (Fig. 5). By using these two portals of entry more adequate implantations may be made into a stenosing mass.

RADIATION COMBINED WITH RADICAL SURGERY

In the case where additional advantage is afforded by radical surgery, the patient usually receives both external and interstitial irradiation before the operation. The object of this combined treatment is to destroy the tumor by radium and remove the devitalized mass by surgery ten days to three weeks after the implantation of gold seeds. The dose of interstitial irradiation in all cases should be sufficient to devitalize all the malignant cells of the tumor, provided the mass were allowed to remain. Moreover an overdose of gold seeds may be safely employed, as the accompanying reaction of a large dose of radium is prevented by early resection of the rectum. The dose of external irradiation may be varied in accordance with the malignant characteristics of the cancer. Tumors of the higher grade of malignancy, in which there is a great possibility that some of the adjacent lymph nodes may be involved, should receive intensive external irradiation; while tumors of a less malignant nature, in which glandular involvement is unlikely, are given only a moderate application of external irradiation. Preoperative irradiation appears to be more appropriate than postoperative irradiation. In the former instance, the tumor mass is utilized as a holder for the radium. This factor provides for adequate dosage at the most distant infiltrated areas, whereas, after surgical removal of the bulk of the primary mass, the landmarks are indistinct, and it is a difficult problem to place the seeds so as to obtain sufficient dosage to destroy the malignant cells in the widespread scattered areas. However, in the exceptional case postoperative radium therapy has been found to be a real advantage.

PALLIATIVE APPLICATIONS IN THE UNFAVORABLE GROUP

Many patients, because of old age, poor general condition or advanced disease are often benefited more by palliative than by radical procedures. Less radical applications in this unfavorable group provide degrees of palliation according to the clinical and pathological aspects of the given case. Such applications are capable of lessening or causing a disappearance of the symptoms by reducing or inhibiting the activity of the cancer. Although the mass does not disappear, the patient may remain free of symptoms for months or even years.

A number of patients with adenocarcinoma of the rectum, at the Memorial Hospital, have received palliative applications over periods of three, four and five years and one patient, treated first in 1920, is at present in good general condition although a large mass still remains in the rectum.

External irradiation by the element pack and interstitial irradiation with gold seeds

appear to be the most valuable applications for this type of case. The technique of application, however, is varied in accordance with the extent of the disease and the ability of the patient to withstand treatment. While the favorable cases receive within a few weeks sufficiently intensive applications to cause the disappearance of the tumor, the unfavorable group is given smaller doses. These palliative applications are extended over a comparatively long period of time.

Patients selected for intensive palliative treatment are given, at the beginning, a pelvic cycle of external irradiation employing two, three or five portals of entry. The intensity of these applications varies between two-thirds and a full erythema dose. The cycle of external treatments is followed a week later by the implantation of gold seeds, the dose of which is about one-half to two-thirds the amount which would ordinarily be employed in a favorable tumor of similar size. Seeds of about 1.25 to 1.50 mc. are frequently used. As the patient is considered incurable, our object in using the decreased dosage and the smaller seeds is to restrain the activity of the tumor and obtain an almost immediate improvement in the general condition, together with a lessening or disappearance of the symptoms. Interstitial applications of too great an intensity are followed by severe reactions which defeat their purpose. The preservation of the skin for future applications of external irradiation must not be overlooked. The above doses, although not severe, are usually sufficient to check the disease. Patients are examined at intervals of two to eight weeks and subsequent applications by either method are employed as the tumor shows evidence of activity. These methods of applications provide a comparatively comfortable life for many of these patients.

Patients suitable for mild palliative treatment are greatly benefited by external irradiation alone. The intensity of such applications is governed largely by the accompanying reaction and the ability of the patient to stand radiation. Small doses of gold seeds are also of value, particularly so when the tumor is of a radioresistant nature. Although the symptoms of these advanced stages may be reduced to a degree in which the patient is comparatively comfortable, the extension of life of the patient is seldom more than an additional six months. There is not any uniform dose or routine method of application in this type of case. Each patient must be considered an individual problem and the application varied accordingly.

SUMMARY

1. The favorable results obtained in the use of radium in cancer of the rectum are dependent on the choice of the methods of application and the proper technique in their use.

2. Interstitial irradiation by heavily filtered gold seeds and external irradiation by the element pack are the methods of choice, but high voltage roentgen rays may be substituted if sufficient radium is not available for external applications.

3. Fishhook implanting needles permit more accurate placing of the gold seeds in certain types of tumors.

4. Colostomy is necessary for proper implantation of the seeds in certain types of rectal cancer.

5. Surgical measures combined with these methods of radium application are essential in certain cases, and the choice of treatment is determined by the anatomy, type and extent of the lesions.

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ABSTRACT OF DISCUSSION

DR. H. H. BOWING, Rochester, Minn., asked whether Dr. Binkley had ever had any post-irradiation difficulties or complications from his implantation technique. He stated that malignant disease of the rectum is an important field for radiologists, for although surgery takes care of many such patients, there is still a large number which can be definitely benefited by irradiation. Cases should be well selected for intensive therapy, since palliation is usually all that can be expected. The majority of these malignant lesions of the rectum are adenocarcinomas and vary in their response to irradiation. Broders has graded

them as low as 1 and some as high as 4, but the latter are not common.

It is impossible to obtain or maintain a surgically clean field for treatment, and a sterile field is an important feature of the technique of implantation. When treating the inoperable cases in which palliation alone can be expected, surface irradiation is employed by using the universal silver tube with 1 mm. of brass and probably 2 or 3 mm. of Para rubber. When there is a crater or ulcer, 2 mm. of lead is added. The time of application varies from four to eight hours and the number of areas varies with the size of the tumor. One case of a bulky lesion was electrocoagulated. Within two weeks only the base of the tumor remained and direct applications were then employed.

DR. CURTIS F. BURNAM, Baltimore, stated that he rather preferred to implant small gold tubes or needles with silk cords attached for removal. He thought the surrounding area could be better protected in this way than with the permanent radon implants. Screens to protect the posterior wall for a period of a few hours or a day can then be applied.

DR. BINKLEY, in closing, stated that in one case in which the tumor was situated in the upper rectum a retrorectal abscess followed the implantation of unfiltered seeds. No deep-seated infection has followed the use of gold seeds. Hemorrhages occur about as frequently in untreated as in treated patients and are more common with the cellular and infected types of tumor and when overdosage of emanation is employed. He thought that removable gold tubes with cords attached had no advantage over the non-removable seeds. Moreover, the latter are more easily placed and retained in position. There is no comparison between the value of gold and unfiltered glass seeds in the treatment of rectal cancer. The gold seeds are applicable to all shapes and sizes of tumors in the different locations and offer the most efficient method of irradiation.

THE TREATMENT OF MALIGNANT NEOPLASMS IN THE MOUTH*

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THE subject of malignant neoplasms of the mouth is one of great importance. In the first place, the mouth is one of the most common sites in which to find carcinoma, particularly in the male; in the second place, we see some of the most malignant types of neoplasm in this region, and, in the third place, because we get some of our best therapeutic results, and we experience some of our worst failures in this very same region. From the point of view of accessibility, cancer of the mouth may be compared with cancer of the cervix which is sometimes referred to as the radiologist's ideal area for treatment. Historically, too, the development of the treatment has been similar for, in both these regions, this was at first entirely surgical and, in both, the general tendency is now to rely more and more upon radiation therapy. In cases of suspected carcinoma I make it a rule, as part of the routine differential diagnosis, to do a biopsy, using, preferably, the bipolar high-frequency current with a small stiff loop of wire as the active electrode. This is pushed into the tissues, drawn through, and pulled out, thus freeing, without hemorrhage, a small piece of tissue the size of a split pea. There is small danger of spreading metastases by this method, and the application of the heat is not sufficiently prolonged to stimulate the remaining malignant cells.

The next step in the process should be the cleansing of the mouth, the removal of bad teeth, the frequent application of mild antiseptics, etc. Measures are taken to increase the elimination of toxic material and, when anemia is present, drugs are given to stimulate the blood-forming organs, a liver diet is sometimes ordered, and irradiation of the entire body with the ultraviolet light prescribed. Simultaneously, a course of roentgen-ray applications is begun over the lymphatic areas of both sides of the neck. If a large amount of

* Read at the Thirteenth Annual Meeting, AMERICAN RADIUM SOCIETY, Minneapolis, Minn., June 11–12, 1928.

radium is available, it is possible that prolonged treatment with hard gamma rays (as recently advocated by Dr. Pfahler) will give better results than high voltage roentgen rays, on the presumption that, in equal amounts, gamma radiation has a considerably greater biological effect than roentgen rays. Unfortunately, however, very few of us are in possession of sufficient radium to make use of this technique. At the present time I am treating these cases, at the Philadelphia General Hospital, with a water-cooled tube activated by 200 kv., and 12 ma., using a filter of 6 mm. aluminum. The erythema dose under these conditions has been estimated to be 270 ma-min. When possible, daily treatments to both sides of the neck are given so as to bring the total radiation received to a full erythema dose within a week. Then, using Dr. Pfahler's "saturation curve," we attempt to maintain this condition for at least a week or ten days longer.

This treatment, plus the concurrent efforts to clean the mouth, often gives surprisingly good results. Quite extensive glandular swelling, whether inflammatory in nature, or due to malignant metastasis, may be found greatly reduced in size or, occasionally, to have disappeared. The appearance within the mouth will also have changed. It should now be possible to definitely distinguish the extent of malignant involvement, and, without further delay, to institute active local treatment. Permit me, here, to interpolate a few words with regard to radiation treatment in general. With many others, I believe that there is some form of general body resistance to malignant cell invasion and, consequently, that any form of treatment tending to lower this resistance is to be avoided. Hence, I have always taken a stand against heavy external irradiation. I recognize, however, that strong irradiation has a lethal effect on tissue cells, particularly upon the young actively growing cells found in neoplasms. I also recognize Regaud's claim, that irradiation should be continued for sufficient time to affect succeeding generations of newly formed cells. And, finally, I appreciate that second only in importance to the lethal action on the neoplastic cells, is the formation of a limiting capsule of fibrous tissue around the malignant tumor.

But can all these factors be dealt with by any one method? Not quite, perhaps, nor would it be desirable to limit one's self to one method, but largely so, I believe, by the *proper* use of gold implants containing radon. In the first place, heavy lethal dosage can be given directly to the malignant cells without affecting to any great extent the normal tissues, hence general body resistance is not diminished. Again, by the use of gold tubes with a wall thickness of 0.3 mm., only gamma rays reach the tissues, and their effect is continued for a considerable time. It is true that still longer treatments may be given by using platinum needles containing radium element, but these are not without their objections, and, what is of practical importance, they are not as readily available to radiologists in general as are gold or platinum implants.

The secret of success in this form of treatment is the use of sufficient radiation, and its uniform distribution within and, of more importance, around the area of malignant involvement. Too often a few tubes are buried directly within the neoplasm, with but temporary beneficial results, when double, or treble the number of tubes placed not only within the lesion, but surrounding it, within *apparently* normal tissues, will be productive of more lasting benefit. It is my belief, too, that when treating many mouth cases, better results are obtained by introducing the implanting needles through the skin, when possible, rather than through the mucous membrane, in order to avoid secondary infection. Care must be taken, of course, not to push the needles all the way through, nor to deposit the tubes in too close proximity to mucosa or bone. Doses vary according to the extent of the areas to be treated. In tongue cases I have used totals of from 2500 to 4500 mc-hr. of treatment. When using the larger doses it may be necessary to protect neighboring parts of the mouth by thin lead screens for the first part of the treatment, at least, while the radiation is most active.

Certain tumors, particularly those involving the tonsils, respond well to

topical applications of radium. This is held in place by applicators designed to suit each individual case, including protection to the rest of the mouth. The dose will depend upon the conditions present, and is estimated on the basis of 60 mc-hr. per square centimeter of area treated.

Neoplasms of the hard palate are most effectively dealt with by destroying them by electrocoagulation. Tumors involving the gums and alveolar processes may be likewise destroyed. However, a roentgenogram should be made previous to treatment and if no osseous involvement is found, great care should be taken not to cause the death of the bone by heat, as this will involve a long drawn out process of healing, including the ultimate formation of a sequestrum which is sure to become infected and cause much pain.

Malignant involvement of the cheek may also be destroyed by the electrothermic method, but this must be done radically, if at all, for outlying cancer cells which escape destruction appear to be stimulated by the heat, or by the resulting inflammatory reaction in the surrounding tissues. If the cheek involvement extends through to the skin, the safest policy is to radically destroy all these tissues and later, when all evidence of malignancy has disappeared, to reform the cheek with a flap of tissue taken elsewhere.

The subject of the treatment of glandular involvement in the neck remains a controvertible one, in which it is not wise to attempt to adhere to any fixed rule. Rather, it must depend upon the conditions found in each individual case, the more important of which are: the age of the patient; his general condition, and the condition of the arteries; the extent of glandular involvement; whether the glands ar emovable or adherent; the type of the primary tumor, etc. Another factor which should influence the choice of treatment is the availability of the treatment chosen. Neither surgery nor radiation therapy should be attempted by anyone lacking sufficient experience in the treatment of these cases. Where a choice must be made between the two, a good surgeon is better than a poor radiologist, and a good radiologist, better than a poor surgeon. Most of the cases seen at the Philadelphia General Hospital are so far advanced, or offer such poor surgical risks, that block dissection of the neck is rarely attempted at the present time. Whether surgical measures are used or not, a thorough course of external radiation treatment should be given to both sides of the neck, using either roentgen rays, or radium, or, sometimes both.

Finally, a few words with regard to the relief of pain. When this is moderate and of short duration it can be controlled by drugs, but some other method must be used where pain is severe and likely to be of long duration. This is a matter of practical as well as humanitarian importance as it permits these patients to escape the toxic effects of constant drug taking and enables them to eat and sleep, matters essential to their general well-being. This is accomplished by the resection of the sensory nerves to the involved areas. Dr. George Dorrance, who has the surgical care of these cases at the Philadelphia General Hospital, considers the extracranial operation sufficient in most cases. However, in 2 instances a craniotomy was performed and the sensory roots of the fifth nerve were cut; the branches of the cervical plexus were resected in 7 cases; in 6, alcoholic injection of the Gasserian ganglion was made; 5 had an alcoholic injection of the third division at the foramen ovale; and one had an injection of the lingual nerve. All of these patients were greatly relieved.

DISCUSSION

Dr. James J. Duffy, New York City, discussed the treatment of the nodes of the neck. Their policy has been one of conservatism and only those patients are operated on who have limited metastases to non-perforated nodes. In a recent study of the intra-oral group admitted from 1917 to 1925 inclusive, it was found that only a small proportion of patients admitted without cervical metastases developed metastases in this region during the treatment or for a period of at least two years. One is not justified in routinely extirpating the nodes of the neck when no metastases are palpable. The fewest number of metastases occurred in the laryngeal carcinomata. The other extreme was in carcinoma of the tongue,

but even in this location 60 per cent remained free of cervical metastases for at least two years after admission to the hospital. This was attributed to the heavy irradiation given. Starting with 8000 mc-hr. at 6 cm. distance, to each side of the neck, this has been stepped up until now practically a full dose of radium radiation is applied to each side of the neck, and to this is added a sub-intensive dose of roentgen rays to each side of the neck, so that within a period of ten days a patient receives two erythema doses to each side of the neck. There results a sharp reaction, but in three to five weeks the skin returns to nearly a normal condition. When metastatic nodes of the neck are unilaterally palpable and operable, a block dissection is done. When they are inoperable and have perforated the capsule, the method of choice is to surgically expose and bury the gold seeds in the nodes under vision and touch, and not to try to reach the node through skin puncture. If the primary lesion is the so-called transitional cell type, that case is reserved entirely for irradiation. They are never submitted to operation.

Dr. George E. Pfahler, Philadelphia. I have been interested in the treatment of carcinomatous lesions of the mouth for thirty years, but have not developed enthusiasm about their treatment until the last four years. As some of you know, I have previously discussed the subject from the standpoint of electrocoagulation, but that has always involved great mutilation, suffering, and so forth, all of which I would like to avoid. At present my aim is to produce as little traumatism as possible in the cancer tissue or anywhere about it. We always take a section for microscopic study, but we do this as gently as possible, and usually with a knife or pair of scissors for the sake of avoiding traumatism.

Our best results have been obtained by the use of surface applications of radium inside the mouth and externally, using highly filtered radium with the equivalent of 2 to 4 mm. of lead, and as much distance as practicable inside the mouth, and about 4 cm. distance externally, and we are able to prolong this irradiation effect during a period of three to four weeks of almost daily treatment. I agree with the impression given by Dr. Bowing in a previous discussion, that the prolongation of treatment has a different effect, as has been definitely proven by Regaud. In this way we do get results. I think Dr. Morgan saw several private patients I demonstrated about two weeks ago. I have a gram of radium and about 800 mg. in the form of needles. I think I have inserted needles into tissues about half a dozen times since the first of January, which will give you an idea that I am losing enthusiasm about the intensive use of radium. In the few cases we have treated, which amount to about 60, by these methods, we have introduced radium needles into the hard edges about ulcerated carcinomas which do not seem to yield satisfactorily to surface applications of radium, and we get results. In a few cases we have used electrocoagulation, but I am not sure that it was necessary even in those cases. We have used, generally speaking, from 20,000 to 53,000 mg-hr. of radium. The patient who received the maximum dose had a carcinoma involving half the tongue. This disappeared after using about 33,000 mg-hr., using about 2000 inside the mouth and about 30,000 externally. After a year the patient came back with a recurrence. He had no skin damage to his tissues anywhere. I was afraid to add more irradiation, and I told the patient I was afraid I would do damage but was sure the carcinoma would kill him if I did not treat it further. He said he wanted the treatment used. That was last September. We added about 20,000 mg-hr. externally and a good deal more inside the mouth. He was one of the patients that Dr. Morgan saw the other day. He could stick out his tongue as well as any of them and had no damage to the skin or to the mucous membrane of the mouth. I think when we get up to this dose, whether we use lead or gold or some other material, the biological effect on the tissues is very different from the rays below that point, and I think that for some reason we get a different action on the cells from that grade of filtration than with lower filtration. I have finally become enthusiastic over the treatment of carcinoma of the mouth. I have seen 2 cases of carcinoma of the lower jaw bone, definitely typical carcinoma, heal under the irradiation I have described, and up to this time we have thought that when the jaw bone was involved, the only proper treatment was to remove the diseased area.

Dr. H. H. Bowing, Rochester, Minn. I have always considered radium treatment from the standpoint of conservative and of radical treatment. It is my policy to consider conservative methods first for I have been impressed with the good palliative results that can be obtained from highly filtered radiation externally applied. If we fail to bring about a good clinical result following a period of two to three months we may go on to more radical treatment. I have treated a few lesions of the mouth with external irradiation. I can match Dr. Pfahler's cases with those in which injury was not done, and the extent of palliation has been remarkable.

Dr. Henry Schmitz, Chicago. Recently

I had a discussion with Dr. Pettit, who had just returned from a visit to Belgium, and he showed me several photographs he brought from the institute there. The following technique was used: To every 5 cm. of the carcinoma a 10 mg. radium capsule was applied externally, filtered with 2 mm. brass, at a distance of 5 cm. This was applied for as long as eight days at a time. If there was a carcinoma about 15 cm. long on the jaw, extending from the zygomatic arch to the neck, they would apply 100 mg. The results in the photographs seemed very remarkable. This coincides with the observation which Professor Regaud reported to us when he was a guest of this society. They make a molded wax applicator and use the radium in that.

I think the observations reported by Dr. Pfahler should make us think, for probably we can get very much better results with this therapy if this method is used. We will not cause undue trauma or undue necrosis from the action of the radium itself. I am eager to hear what the results will be a year or two from now.

DR. MORGAN (closing). I feel that the object of my paper has been accomplished. The resulting discussion has brought out some very important points. The question of operation on the glands, as I mentioned, is controversial and will probably remain so, although the very encouraging results which Dr. Pfahler has reported, following the use of highly filtered gamma rays, may be the answer to it. I can testify to the remarkable results I saw in the cases Dr. Pfahler showed at a recent course in cancer therapy, held in Philadelphia. The patients were not mutilated in any way and the results were thoroughly satisfactory. I think it also points to the necessity, if the results of this treatment continue to be as promising, of all hospitals becoming centers for radium treatment, for it will be impossible for the general radiologist to possess sufficient radium to adequately follow this technique.

THE TREATMENT OF MALIGNANT NEOPLASMS WITH COLLOIDAL LEAD*

BY D. S. PULFORD, M.D., AND JOHN D. LAWSON, M.D.

WOODLAND, CALIFORNIA

WE have been working at the Woodland Clinic for a year on colloidal lead injection for malignancy. A few cases have been followed long enough to be recorded as a stimulus for discussion.

The progress and ultimate result of a malignant neoplasm varies with many factors other than treatment. The known influencing factors in each case should be considered before drawing conclusions concerning any new method of treatment. Chief among these are: (1) site of origin; (2) age of patient; (3) duration before treatment; (4) size of tumor, and (5) grade of malignancy.

It is difficult to arrive at an accurate estimate of the relative value of the different methods of treatment of malignancy when two or more agents are applied to one patient at the same time. In the intravenous injection of colloidal lead solution we may have a new and powerful aid in the treatment of malignant disease. Most of the work up to the middle of 1927 was with the Blair Bell *metallic* colloidal lead solution. Not only has this been proven quite toxic, but not selective for trophoblastic or lecithin-filled cells.

The object of this paper is to record certain observations on the results of treating malignant disease with Bischoff's non-toxic colloidal tri-orthophosphate solution of lead which seems safe for the patient. It remains to be seen if it is as death dealing to the malignant cell as was the more toxic metallic lead solution of Blair Bell. Studies were started a year ago to help determine, if possible, the following clinical points:

1. The optimum single milligram dose of colloidal lead.
2. The best time interval between doses.
3. Its effect on the blood and the kidney and liver functions.
4. Its effect with and without associated roentgen therapy.

* From the Departments of Medicine and Radiology, Woodland Clinic, Woodland, California. Read before the California State Medical Association, May 1, 1928.

5. The relation of the degree of malignancy of the tumors treated to results obtained.

6. The possibility of repeated remobilization of lead.

The major effort is being given to recording the relation of the degree of malignancy with the results of lead treatment; the effect of lead without roentgen therapy, and to establishing a satisfactory system of remobilization of lead so that paralyses do not occur when the patient is for some reason thrown into an acidosis.

HISTORY

I need but mention the very excellent work of Stone and Craver[1] of the Memorial Hospital of New York; of Wood;[2] of Meland, Soiland and Costolow[3] of Los Angeles; and the Santa Barbara group:[4,5,6,7] Ullmann, Nuzum, Evans, Bischoff et al, who have given to us our present non-toxic solution.

The general impression from these authors' reports is that colloidal lead *per se* is not a cure for malignancy, but that in certain cases and under certain conditions it definitely arrests growth of the malignant cells, in some cases destroying them and in many intensifying the natural regressive changes in tumor masses. It should be noted in the review of this work that most of it was done with metallic colloidal lead and that other agents such as roentgen rays and radium were used in conjunction with the lead.

It is evident from the reports in the literature, that, in this country at least, the use of intravenous colloidal lead in the treatment of malignant disease is still in its experimental stage. There is nothing to approach the remarkable results reported by Blair Bell, such as 23 per cent of clinical arrests in 250 inoperable cases.

MATERIAL

Since June, 1927, eleven months ago, we have treated 19 cases of malignancy with colloidal lead. Eleven of these have received sufficient lead over a long enough period to justify a discussion of the results. The primary sites of malignancy of the 11 cases under discussion were as follows: stomach 6; breast 3; ovary 1; skin of back 1.

DOSAGE AND INTERVAL

We have used exclusively the Bischoff preparation of colloidal tri-orthophosphate of lead as sent us from the Santa Barbara Cottage Hospital. We have injected at a single dose up to 100 mg. of this solution without evidence of immediate toxic effect, and as much as 600 mg. in periods varying from seventeen to fifty-one days, without definite evidence of kidney, liver or blood destruction of any grave moment. The dosage we employed in the earlier cases was 40 to 50 mg. every second to third day up to a total of 160 to 200 mg. in the first course. A rest of two weeks to a month was then allowed. Remobilizing the lead from time to time by producing a mild physiologic acidosis by the use of ammonium chloride or parathormone injection was then tried. A ketogenic diet may be useful if the patients are not vomiting. The total quantity injected is judged by the percentage of red blood cell stippling. At present we are using, as Ullmann[7] has suggested, 100 mg. doses at five to seven day intervals up to 400 mg. in the first course of lead. Fifty mg. every other day seems to be equivalent to 100 mg. at weekly intervals, neither causing any marked degree of anemia.

Theoretically, deposition of lead in the cells of the malignant tumor should increase the susceptibility of those cells to irradiation. The heavy metal should give rise to an increase in secondary rays and cause greater destruction of cells. With this point in mind we have subjected most of the patients reported in this series to intensive short wave therapy. Iontoquantimeter determinations were not made but clinically no increase in susceptibility was noted.

LEAD TOXICITY

Clinical signs of definite lead toxicity were observed in 2 out of 19 patients. A patient carrying a grade 4 carcinoma of the breast died six months after treatment was begun, 728 mg. of lead having been given in all. Death came from general paralysis, with a thoracic type of breathing as of diaphragmatic paralysis having existed for five days. She was unable to swallow and dyspnea was extreme. Red blood cell

stippling was 2.4 per cent five days before death.

Another patient suffering from a carcinomatous pseudomucinous cystadenoma of the ovary, grade 2, recurrent (first operation in 1911) with general abdominal

FIG. 1. Lung metastases showing liquefaction. Lead treatment of grade 4 carcinoma of stomach (Yusai).

metastases, developed a lead encephalopathy about two weeks after receiving 330 mg. of colloidal lead divided in seven doses over a period of five months. She became mentally confused, sluggish, restless and irritable and unable to write or say what she thought, and then suddenly suffered an epileptic-like attack with clonic convulsions followed by unconsciousness. The blood at this time showed a marked secondary anemia and basophilic stippling of 1 per cent. A spinal puncture revealed a clear fluid under 25 mm. pressure, 2 cells per cubic millimeter, and a slight increase in globulin. An analysis for lead of a portion of this fluid, made by Bischoff, was negative by a test sensitive even up to 1:200,000 dilution. There was mild delirium for a few days; no choking of the optic discs. In spite of large doses of potassium iodide and calcium lactate the basophilic stippling of the red blood cells arose to 2 per cent. Three weeks later another similar spell of unconsciousness, preceded by a severe convulsion developed. The patient recovered a relatively normal mental condition but died of general toxemia two months later without colic or extensor paralysis of any kind. It is possible, though hardly probable, that this patient's symptoms were due to a brain metastasis and it is unfortunate that an autopsy was unobtainable.

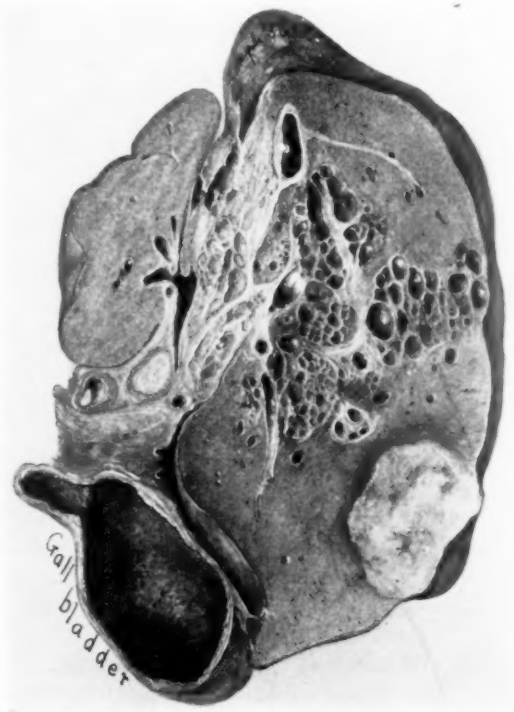

FIG. 2. Liver nodule from grade 4 carcinoma of stomach. Lead treatment of malignancy; post mortem change.

One minor immediate transitory reaction occurred. About one-half hour after the seventh injection of 40 mg. of lead totaling 280 mg. in fifteen days, a man who had had a posterior gastroenterostomy for an inoperable obstructing carcinoma of the pylorus, grade 2, had a severe chill and a temperature of 101°F., which lasted about two hours. There were no permanent effects

noted and an injection of a different and newer solution of lead two days later was not followed by any untoward symptoms.

BLOOD, KIDNEY AND LIVER CHANGES

At no time was anemia noted out of proportion to that which might be expected from the carcinomatosis present.

It should be noted in passing that the anemia of malignancy is similar to that of pernicious anemia in that a high vitamine liver diet has been shown in two patients to bring out reticulation in the red blood cells and to increase the red blood cell count itself, together with the hemoglobin. This would point to the fact that the so-called primary anemias and the anemias of malignancy are due to a similar toxin. Further study of this subject is in progress.

Stippling of the red blood cells commands our attention as a clinical phenomenon for it is the one best guide to dosage in lead therapy of malignancy.

There is considerable individual variation in stippling as in other reactions to lead. Our patient who died following encephalopathy showed no stippling at the time of death and early in the treatment showed only an occasional stippled cell eleven days after receiving 150 mg. of colloidal lead in divided doses.

One patient received 590 mg. of colloidal lead over a period of fifty-one days and at no time showed any stippling; another, 340 mg. in seventeen days without stippling. As a rule, 150 mg., given 50 mg. at a dose, at two or three day intervals, will produce occasional stippling.

The greatest amount of stippling observed was 3 per cent a few days before death in a case of non-melanotic melanoepithelioma of the back, in a patient who had received 390 mg. of colloidal lead over a period of thirty-four days.

Kidney function tests revealed no striking damage from the lead injections—a trace of albumin and an occasional red blood cell in the urine was often noted and, in the very sick, a reduction in the phenolsulphonephthalein. Apparently the urea figures were not appreciably changed by the lead *per se*, nitrogen retention being observed only just before death from toxemia. Even up to the time of death the urinary output has been normal in all cases.

Liver Function. Tetrabromphthalein liver function tests showed dye retention of grade 1 shortly before death in two cases and grade 2 in two other fatal cases one of which was a terminal affair, the other in the presence of jaundice and therefore not significant. So far as our observations go, the present solution of lead as given does not damage to any extent the liver function as tested by the dye retention method.

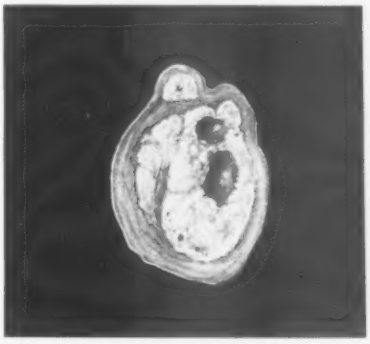

Fig. 3. Gland from abdomen, grade 2 carcinoma of stomach, colloidal lead treatment case. Central necrosis before lead was given.

RESULTS

With the exception of the patient who died with complete paralysis six months after treatment began, and the one with a lead encephalopathy, no serious toxic manifestations have appeared in our patients. The lead has certainly not had any permanent effect on the general condition of those living and all the symptoms of whose who died are seen daily in cancer patients dying without receiving lead.

Of the 11 patients under discussion, 9 are dead, 6 autopsies have been obtained. In only 2 was a definite lead effect upon the tumors noted. A grade 4 cancer of the stomach with extensive metastases into the retroperitoneal, mesenteric and mediastinal lymph nodes, liver and lung, showed reduction in size and lessened pain in the abdominal masses and a partial liquefaction of a large lung nodule, resulting in a lung abscess. This patient died six weeks after lead treatment was started, of cancer toxicity and starvation. A grade 4 cancer of

the breast with axillary, supraclavicular and mediastinal lymph gland metastases showed a marked regression in the size of the tumor metastases and a softening and mobility of the axillary nodes.

This case exemplifies the effect of the lead alone, separate from roentgen therapy. The tumor was of such a type and degree of malignancy that death in a short time could be predicted in spite of surgery, roentgen rays or radium, so that withholding roentgen treatment and giving lead alone did not, we believe, rob the patient of many months of life. It seemed as if this patient were on the high road to recovery when, six months after starting treatment, she died, completely paralyzed and with a severe lead poisoning, as showed by stippling of red blood cells of 2.4 per cent.

RELATION OF DEGREE OF MALIGNANCY TO LEAD EFFECT

The tumors reported were of the following grades of malignancy:

Site	Grade	Number
Stomach	4	2
Stomach	3	2
Stomach	2	1
Stomach	No biopsy	1
Breast	4	2
Breast	3	1
Ovary	2	1
Skin of back	4	1

Inasmuch as the longevity of a cancer-bearing patient depends a great deal upon the degree of malignancy irrespective of the treatment, it is not surprising that all the grade 4 group are dead. The one grade 4 carcinoma of the breast which received lead alone, without irradiation, showed regression of the metastatic nodules equivalent to that ordinarily produced by roentgen therapy. It is unfortunate that the patient died of lead poisoning.

Microscopic examination of the tissues so far studied shows so little lead effect that it is not possible to say whether or not the grade of malignancy has any bearing on the probable efficacy of lead.

Direct injection of 1 c.c. of colloidal lead into surface nodules recurrent in the wound of the grade 4 epithelioma of the back did not produce recognizable microscopic change when excised two days later. These nodules were not covered with skin and the solution evidently passed right out of them.

Excision of a gland from the grade 2 carcinoma of the stomach, before lead treatment showed a spontaneous central necrosis.

At present the degree of malignancy gives one justification for using lead alone to the exclusion of radiation, since the grade 4 cases die in short order irrespective of the type of treatment, and for starting some patients on lead injections when they are still in good condition.

REMOBILIZATION OF LEAD

The remobilization of lead which is so rapidly stored in the bones as an orthophosphate was accomplished in one case by the administration of ammonium chloride by mouth.

A patient with a grade 4 carcinoma of the stomach with general abdominal metastases developed ascites and a hydrothorax. His plasma CO_2 was reduced from 60 to 40 volume per cent in the process of producing the acidosis requisite to promote voluminous diuresis by the injection of novasurol. There had been no stippling of the red blood cells up to this point. They now occurred to the extent of 1 per cent, definite evidence of circulating lead. No further intravenous lead had been given.

Another patient now under observation with almost identical findings after the injection of parathormone (Collip) U-10 three times a day shows 0.3 per cent increased stippling. This patient had received 300 mg. of lead up to three weeks before these injections.

SUMMARY

1. Of 11 patients with malignant disease treated with colloidal lead intravenously, 9 are dead and the other 2 unarrested. Two of them showed definite signs of tumor regression before death.

2. The colloidal tri-ortho lead phosphate as furnished by Bischoff is non-toxic if used in single doses up to 100 mg., but dangerous in its cumulative effect.

3. It is our opinion that a safe dosage is

50 mg. every second or third day up to 200 mg., further injections being judged safe or not by the degree of basophilic stippling of the red blood cells. However 100 mg. doses given at weekly intervals up to 500 mg. has not proven harmful. So from 1 to 1.5 mg. per kilogram body weight may be considered a safe range.

4. Very little anemia was caused by this solution of lead and no serious kidney damage was noted.

5. The brom sulph-phthalein liver function test did not give evidence of liver damage.

6. There are not sufficient data at hand to say whether or not the degree of malignancy plays a rôle in the cancer cells' affinity for lead.

7. Lead can be remobilized from bones by ammonium chloride acidosis and also by Collip's parathormone, extract of the parathyroid gland.

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Publishers: PAUL B. HOEBER, INC., 76 Fifth Avenue, New York City.

Thirtieth Annual Meeting, 1929: To be announced.

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Fourteenth Annual Meeting: Portland, Oregon, July 8–9, 1929.

Committee on Arrangements: To be announced.

EDITORIALS

COMMITTEE ON THE COST OF MEDICAL CARE

THE Committee on the Cost of Medical Care has been created to study a problem of great importance not only to physicians, nurses, dentists, hospitals and all other agencies concerned with care of the sick and promotion of health but especially to that vast number of people in the United States who sooner or later require the aid of some of the above persons or agencies. That it is a question of real importance is attested by its wide and increasing discussion in newspapers, popular magazines and forums, as well as in meetings of physicians, public health officers, economists and sociologists. The following statement of Dr. Olin West, secretary of the American Medical Association, does not exaggerate the importance of the problem: "The one great outstanding problem before the medical profession today is that involved in the delivery of adequate scientific medical service to all the people, rich and poor, at a cost which can be reasonably met by them in their respective stations in life."

There has been some opposition to the proposed work of the committee by those who assume that any solution of the problem must lie in the direction of health insurance or state medicine. Such an assumption is not justified by any known facts. It is the lack of information with regard to all of the elements which enter into the problem that has led to the organization of this committee. The publication of isolated instances of real or apparent overcharging by individual physicians has led some to believe that this is a large element in the excessive cost of medical care. Only a little investigation, however, has disclosed the fact that although there are predatory individuals in the medical profession just as there are in business or other professions, still physicians as a class are not being paid too much. The preliminary statement of the committee on this question is that, "It is doubtful whether the income of a majority is adequate. The cost of medical education (often $10,000 or more), together with free work at the homes of clients, uncollectable bills, free service in hospitals and clinics, failure to charge for preventive work and high cost of equipment and living—these various items often reduce the net income to an amount far from satisfactory. It has been estimated that the physicians of Denver, Colorado, give at least one million dollars worth of services per year without charge. Dentists, nurses and others engaged in the cure and prevention of disease are surely not getting rich at the expense of the sick. It is the large number of separate charges, in many cases, which causes hardship." It is recognized by the committee that citing individual instances of overcharging by doctors, as is often done in magazine articles, is of no scientific value in arriving at a solution of this problem.

Dr. Ray Lyman Wilbur, former president of the American Medical Association, chairman of the committee, has made the following explanation of the committee's work: "The study is not an investigation of the charges made by the 140,000 physicians engaged in private practice. It is a study of all kinds of medical care as rendered by 1,000,000 persons employed in various capacities on a whole time basis, in office or home, or (in an increasing proportion of cases) in medical institutions now capitalized at approximately $5,000,000,000."

"The committee will deal not only with the cost to the people of hospital care, nursing, dentistry, drugs, physical therapy, surgery and other medical services, but also with various problems involved in the prevention and cure of disease. The demand for medical services and their supply and distribution are the subjects of a preliminary survey. The major group

of studies deals not only with the cost to the family but also with the return accruing to the physician, the nurse, the dentist and other agents furnishing services. A third group of studies consists of an analysis of industrial medical services and other organized facilities now serving particular groups of the population. I am greatly pleased that the American Medical Association is to conduct the study on the income of physicians. The United States Public Health Service and the Metropolitan Life Insurance Company are among other agencies which will participate."

The committee consists of forty-two persons, and an effort has been made to keep the work well balanced by having the following interests represented: private practice, public health, institutions and organizations, economics, and the public.

It cannot be too strongly emphasized that the committee is a fact-finding organization and that any recommendations will be made only after careful interpretation of the facts at the end of the five-year period of study.

DR. HICKEY HONORED

The American Roentgen Ray Society at its recent annual meeting demonstrated in a very special way its respect and esteem for one of its oldest and most influential members, Preston M. Hickey. Dr. Hickey was chosen to deliver the Caldwell Lecture and on the evening of the annual banquet was presented with a silver service. The Caldwell Lecture gave a detailed account of the life of Eugene Caldwell and his contributions to roentgenology. The facts which formed the basis of the lecture were obtained both from Dr. Hickey's intimate personal acquaintance with Caldwell and firsthand knowledge of his work and from exhaustive investigation of published and unpublished writings. The lecture will be published in an early number of the Journal.

The presentation at the banquet was a sincere expression of the affection of the members of the American Roentgen Ray Society for one who has been untiring in his efforts to advance medical science in his chosen field of roentgenology and who has always been the friend and helper of all who came to him for assistance.

The presentation speech by Dr. Percy Brown was as follows:

There are some individuals who, when the Fates ordain that their turn has come for public utterance, cannot overcome an anticipatory feeling of dread lest some error of omission or of commission be made that would not occur were the words to fall from lips more worthy. The speaker is one of these, and his realization of his limitations is just now the more acute because he can so easily err by attempting to refresh, with the poor varnish of weak words, a mental picture of yours whereof the rich and stable pigments need no refreshing.

Of his audience of last evening, those of us who were the contemporaries of Eugene Caldwell felt that no one other than Preston Hickey could have so clearly conveyed to the mind of the younger physician the significance of Dr. Caldwell's professional career, and the influence it continues to exert on the growth of roentgenology.

Dr. Hickey's relation to the younger physician is peculiarly close, not alone because of his position as a teacher and a mentor, but because he himself chooses to remain young. To transcend the years is really a matter of one's own choosing. The son of the Reverend Manasseh Hickey, he was born in the State of Michigan in the year—well, in one of the years of bumper crops! He was reared and educated in Michigan, married a daughter of Michigan, and has continued his career as a practitioner and a teacher within the confines of Michigan, except as he has gone forth to serve his Country and her Allies.

It is known that such close adherence to the branches of one's vine and figtree tends, in some individuals, to create a provincial circumscription of vision and consequent mental stenosis. Why not so with Professor Hickey? Largely because his influence is swept beyond his finite boundaries by his migrating disciples with whom he has maintained such sympathetic contact. Although a fruit of the pedagogic tree, he has not allowed its foliage to inhibit, in

the shade of pedantry, his development; and so he continues to ripen and to mellow without decay.

Therefore, while it were perhaps out of place to inject here even a passing breath of politics, I cannot help venturing the opinion (and I say it within the sovereign state of Missouri and knowing him to be a Democrat) that, measured by everything except the weight of years, Preston Hickey may well be called with pride and affection, the Grand Old "Party" of American Roentgenology!

His services to this Society have been signal ones, and they go deeper than many of you realize. Back in the first years of this century, our Society was as a ship sorely beset by unfavorable winds. They were the winds of commercialism, and bade fair to drive us on the rocks. But with Lester Leonard at the helm and sternsheets and Hickey at the foresheets and and halyards, we found the calm and deep water we now occupy.

Preston Manasseh Hickey! Skilful practitioner; respected teacher; authoritative writer; patient demonstrator; champion of stabilized thought and calm diagnosis; personification of patriotism and efficient medical officer overseas; able president of this Society and worthy spokesman for American roentgenology abroad.

It becomes my happy privilege to stand before you as a mouthpiece for the American Roentgen Ray Society. The Society could have selected no one who would have more willingly expressed its affection for you. I am charged with the agreeable duty of presenting to you, in its name, a material token of this affection, which I now do with infinite satisfaction. The laws relating to standards require that, upon each piece of this service shall be stamped the word "sterling." How fortunate and how appropriate, for this is the exact word that has been stamped upon your character by all who know you.

I have little knowledge of the constructive art of the silversmith, but I do know that this pitcher is a container for the milk of human kindness, of which you have such an abundant supply; and that this bowl is the receptacle for that saccharine substance so suggestive of your disposition.

So, as you sit at your tea in the evenings to come, may these polished surfaces reflect, as a background for the faces of your loved ones, the images of the many loving friends who now sit before you!

Subscribers to The American Journal of Roentgenology & Radium Therapy *visiting New York City are invited to make the office of the publishers (Paul B. Hoeber, Inc., 76 Fifth Avenue, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan Ave., Toledo, Ohio.
Thirtieth annual meeting, 1929: To be announced.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual meeting, Portland, Oregon, 1929.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. Fred M. Hodges, 801 West Grace St., Richmond, Va.
Annual meeting, Portland, Oregon, July 8–12, 1929.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. Robert J. May, St. Luke's Hospital, Cleveland, Ohio.
Fourteenth annual session, Chicago, Ill., Dec. 3–7, 1928.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.
Next annual meeting, Asheville, N. C., Nov. 12–15, 1928.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. W. T. Bronson, Englewood Hospital.
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. James H. West, 8314 Euclid Ave.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. O. J. Shore, 2033 Park Ave.
Meets monthly on second Friday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. Carl S. Oakman, Muncie, Indiana.
Annual meeting each February 22 in Indianapolis. Next meeting in Indianapolis, February, 1929.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. John D. Camp, Massachusetts General Hospital, Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. Everett Rowell, 200 West 59th St.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7.45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Metropolitan Building.
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Annual meeting, Galveston, Texas, 1928.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Director, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets on the third Thursday of each month, from November to June inclusive, at 8.15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8. 30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

RADIOLOGICAL SECTION, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. C. A. Anderson, The Hospital, Dunedin.

* Secretaries of societies not here listed are requested to send the necessary information to the editor.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch.
Meets annually.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIETE FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RÖNTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.
Sixth Annual Meeting, 1929, to be announced.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.
Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. H. Scheuermann, Copenhagen
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

THE SECOND INTERNATIONAL CONGRESS OF RADIOLOGY

The Second International Congress of Radiology met in Stockholm July 23–27, 1928, under the presidency of Professor Gösta Forssell, Stockholm. There were 962 members taking part in the Congress, divided among 40 countries: about 400 of the members were accompanied by ladies. The members were divided among the different countries as follows:

America	111
Argentine	5
Australia	1
Belgium	13
Brazil	2
Canada	11
Cuba	1
Denmark	22
Egypt	1
England	81
Esthonia	1
Finland	15

France	31
Greece	2
Holland	22
India	3
Iceland	1
Italy	35
Japan	6
Java	1
China	1
Latvia	4
Mexico	1
Norway	13
Palestine	2
The Philippines	1
Poland	27
Porto Rico	1
Portugal	1
Roumania	13
Russia	83
Switzerland	16
Spain	16
Sweden	143
Czechoslovakia	24
Tunis	1
Germany	219
Hungary	11
Uruguay	3
Austria	17
	962

The festival inauguration of the congress took place in the beautiful Concert House in the presence of H.R.H. The Crown Prince and H.R.H. Prince Charles of Sweden. The president, Prof. Gösta Forssell opened the proceedings by a short speech in which he welcomed the guests, particularly directing himself to H.R.H. The Crown Prince who had honored the congress by his patronage. H.R.H. The Crown Prince then addressed the members and emphasized the gradually growing importance of radiology for the art of healing. The Chancellor of the Universities, Mr. E. Trygger, addressed the congress on the behalf of the universities, emphasizing the importance of radiology as an independent subject of teaching.

As a gift from The British Institute of Radiology, the president and the secretary-general of the first International Congress of Radiology in London, 1925—Mr. C. Thurstan Holland and Dr. S. Melville—presented a presidential badge to Prof. Forssell to be worn by the president of this and all future international congresses of radiology, after which Prof. Forssell responded by a short speech.

Mr. C. Thurstan Holland on behalf of the guests thanked H.R.H. The Crown Prince, the University Chancellor and the Organizing Committee for the work they had laid down for the present congress. Papers were then read by teachers of radiology in different countries with Prof. Forssell delivering the opening paper on the subject of "Teaching and Training in Medical Radiology," the different speakers relating their experiences and mentioning various objects to be desired. These papers will be published in book form, as a supplement to *Acta Radiologica*. Other proceedings of the congress took place in Riksdagshuset (The House of Parliament) and were divided into sections on Roentgen Diagnosis, Roentgen and Radium Therapy, Radiobiology and Heliotherapy, Radiophysics and Medical Radiology. On special invitation six papers were read on chosen subjects by Balli, Italy ("Diagnostics Röntgen surtout au point de vue des organes de l'abdomen"), Holthusen, Germany ("Bestrahlung und Immunität"), Jaches, United States ("Lung Suppuration"), Knox, England ("The Rationale of Radiation Therapy"), Regaud, France ("Curiethérapie à distance") and Reyn, Denmark ("The Combination of Local and General Light-Treatment in Cases of Dermal Tuberculosis").

In the different sections 225 papers were read altogether;

Roentgen Diagnosis	85
Roentgen and Radium Therapy	56
Radiobiology and Heliotherapy	40
Radiophysics and Medical Electrology	44

In the section on *Roentgen Diagnosis* the papers dealt with the various aspects of that subject. Thus different parts of the digestive tract were made the subject of papers (the appearance of the mucous membrane of the stomach, disease conditions and displacements of the small intestine and colon, the roentgen appearance in affections of the pancreas and in free and circumscribed exudations in the abdomen, etc.). The present position of roentgen diagnosis in diseases of the chest was elucidated by a number of papers on pulmonary tuberculosis, atelectasis from different causes, pulmonary syphilis, thoracic cysts and other developmental disturbances, and several members gave the results of their investigations into the function and changes of the domes of the diaphragm. Cardiac disease and anomalies of the

heart, as well as investigations by the aid of densography and chymodensography, also attracted attention. A great number of papers dealt with modern methods of investigation by the aid of opaque injections into the brain and spinal column for the diagnosis of tumors and other disease conditions of the central nervous system (encephalography and myelography), into female genital organs (hysterosalpingography), into kidneys (pyelography and pneumopyelography) as well as the use of contrast means in the examination of the nasal accessory sinuses. Various disease conditions of the bony system (tumors, lues, internal secretory disturbances, anomalies, diseases of the joints, etc.) were also the subjects of numerous papers; different technical subjects were also dealt with (new methods of examination and technical novelties, methods of localization by the aid of roentgenograms, stereoscopy, etc.).

In the section on *Roentgen and Radium Therapy* the chief interest centered around the technique of treatment and the results obtained in the treatment of malignant tumors, elucidated partly by statements of more general character, partly by special accounts in cases of different locations of the tumor. Stress was also laid on the importance of radiotherapy for inflammatory processes (in local superficial inflammations, in pneumonia, in diseases of the joints, asthma and affections of the tonsils). A number of papers also dealt with the roentgen treatment of various nervous diseases, tuberculosis, goiter and diseases of the skin. The organization, technique of treatment and the results obtained at Radiumhemmet in Stockholm were dealt with in connection with a demonstration of about 100 patients. This demonstration aroused the admiration of all those present, and speakers from different countries offered their congratulations on the results obtained.

In the section proceedings on *Heliotherapy* questions were dealt with concerning the effect of light in different diseases, dosage in light treatment; theoretical subjects on the influence of ultraviolet rays on cells and tissues, on changes in metabolism, etc., were also dealt with, besides the results obtained by investigations into the therapeutic value of irradiated oils.

In the section on *Radiobiology* subjects were dealt with referring to the effect of roentgen and radium radiations on the blood, different organs and tissues, the effect of different wave lengths, etc.

In the section on *Radiophysics* a great number of papers were read on various technical and theoretical items in connection with different branches of radiology. This section furthermore had two main themes in its program, viz., the establishment of an international unit of dosage in roentgen treatment and the question of how to obtain international regulations for protection in radiological work. Concerning the question of the international unit of dosage several discourses were delivered. The International Committee on the X-ray Unit discussed this question and agreed on a provisional unit called 1 Röntgen ("r") and corresponding to the German unit.

In order to solve the question of international regulations of protection an International Committee was formed, which resolved to recommend, with a few changes the "Proposals from the British X-Ray and Radium Protection Committee," previously sent out to all the members of the Congress.

During the Congress, the International Committee of Radiology met, there being delegates from 21 countries. At its first meeting on July 23 this Committee appointed an Executive Committee with 7 members: Prof. G. Forssell, Mr. C. Thurstan Holland, Dr. A. Béclère, Prof. W. Friedrich, Prof. M. Haudek, Dr. G. E. Pfahler und Prof. P. Tandoja in order to propose the meeting place for the next Congress based upon preliminary voting among the committee members and to examine a proposal made by Prof. Forssell for statutes for the International Congresses of Radiology, as well as to deal with questions of common interest. Paris was fixed as the place for the Third International Congress of Radiology, 1931, and at the suggestion of the French delegates, Dr. A. Béclère was elected President by acclamation.

The above-mentioned proposal for the

statutes for future International Congresses of Radiology was confirmed, and in addition it was resolved to appoint an Executive Committee in accordance with these statutes to be in force until the next Congress. As members of this committee were elected the delegates, who had acted as Executive Committee members during this Congress. Regarding the suggestions made for the scientific program at the Third Congress of Radiology, as well as questions of general interest referred to the International Committee at this Congress, it was resolved to submit these to the Third International Congress of Radiology.

An exhibition was arranged in connection with the Congress comprising apparatus, instruments, etc., of special interest (apparatus and utensils for roentgen diagnosis and therapy, for radium and light therapy, photographic material, opaque substances and chemical preparations, diathermy apparatus, etc.).

The firms partaking in the exhibition numbered 45 (from Germany 24, England 7, France 1, Italy 2, Czechoslovakia 1, United States 1, Argentine 1, Austria 1, Belgium 1, Holland 1 and Sweden 5).

The proceedings were concluded each day by festivities of different kinds; in the evening of July 23 a reception was arranged for all the members, about 1,400 persons being present. On July 24, Their Majesties The King and Queen of Sweden entertained the members of the Congress at tea at the Royal Palace, at which H.R.H. The Crown Prince on behalf of Their Majesties engaged himself in animated conversation with a great number of members.

On Wednesday, July 25, the Corporation of the City of Stockholm gave a banquet and soiré at the beautiful Town Hall, and on Thursday, July 26, there was a subscription dinner at the Grand Hotel Royal which 800 persons attended.

In order to entertain the ladies several excursions were arranged within Stockholm and its environs during the different days, with visits to the museums and notable buildings.

At the final session on July 27, the Congress resolved to approve of and promulgate the proposals of the X-ray Unit Committee for the ratification of the above-mentioned international unit of dosage in roentgen treatment, as well as the proposals for the international protection regulations. Furthermore, at the suggestion of the Executive Committee the Congress resolved to appoint a committee, which until the next Congress should deal with matters relating to protective measures and kindred questions.

The president of the Congress, Prof. Forssell thereupon submitted a brief report of the work done and conveyed the thanks of the Congress to the newly elected President, Dr. A. Béclère.

Dr. Béclère conveyed the thanks of the delegates to the Organizing Committee of the Second International Congress of Radiology, and expressed their gratitude for the hospitality displayed by Sweden, and especially by the Swedish Royal Family.

During the Second International Congress of Radiology experiences in abundance were exchanged between different countries, fresh impulses to continued research were stirred up and the ties between radiologists of the different countries were still more firmly united to a more intimate international co-operation. For all members of the Congress the days in Stockholm will remain a bright memory.

REPORT FROM THE INTERNATIONAL X-RAY UNIT COMMITTEE

The International X-ray Unit Committee has come to unanimous agreement regarding the Standardization of X-ray measurement, and forwards to the meeting of the delegates of the Second International Congress of Radiology the following proposals for endorsement and promulgation.

(1) That an International Unit of X-radiation be adopted.

(2) That this International Unit be the quantity of X-radiation which, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces in one cubic centimeter of atmospheric air at 0°C. and 76 cm. mercury pressure, such a degree of conductivity

that one electrostatic unit of charge is measured at saturation current.

(3) That the International Unit of X-radiation be called "The Röntgen" and that it be designated by the letter small "r."

(4) That various standard methods be employed to establish the unit.

(5) That for all comparative purposes it is advisable to employ ionization chambers which have been calibrated in terms of a standard chamber for X-radiation of the various qualities employed. It is also advisable to make the wall effects of these chambers as small as possible.

(6) That the practical instrument used to measure X-ray output be called a dosage-meter (Dosismesser, dosimètre).

(7) That the constancy of the indications of the dosage-meter be tested by means of gamma radiation emitted from a definite quantity of radium element, the measurement being carried out always under the same conditions.

(8) That any specification of dosage is incomplete without specifying the quality as well as the quantity of the radiation. The quality of X-radiation used for practical purposes is very varied and it would be impracticable to give a complete specification of it; but much information can be obtained from a knowledge of the degree of absorption of the radiation in standard materials, the peak voltage applied to the tube, together with the filter employed, and the general character of the high tension apparatus.

For practical purposes the quality may be expressed by stating the half-value layer in a suitable material, or by stating the effective wave length as determined by the percentage amount of radiation transmitted through a given thickness of a suitable material (copper or aluminum).

In view of the fact that rapid progress is being made in methods of X-ray measurements and in our knowledge of X-ray phenomena the Committee feels that the above recommendations should be regarded as being of a provisional character.

MANNE SIEGBAHN
Chairman
E. A. OWEN
M. HOLTHUSEN
Honorary Secretaries

SPEECH DELIVERED AT THE OPENING OF THE SECOND INTERNATIONAL CONGRESS OF RADIOLOGY AT STOCKHOLM, JULY, 23–27, 1928

By the President of the Congress

GÖSTA FORSSELL

From every corner of the world there is gathered here this day a host of scientists within the sphere of medicine, numbering approximately one thousand. It must be a strong and great force which has been able to gather together in Ultima Thule from their daily labor in the service of research so many men of science and industrious servants of humanity. That which has united us here is also one of the most significant forces of life: Light.

Light is the source of energy for all living beings upon the earth, and through the organ especially created by Nature for our conception of light, the eye, we gain our knowledge of shape and color and movement in nature. Just as light is a *sine qua non* for life upon the earth, so has it also from time immemorial been used for elevating and strengthening the force of the entire organism. But as a conscientiously and properly used healing agent, to exercise direct influence upon local disease processes, light has not been harnessed to the service of medicine until the last few decades. This was done through Nils R. Finsen's introduction of the artificial, local light treatment. The great advance of light in therapeutics occurred, however, through Röntgen's discovery of the light bearing his name, the roentgen ray, and after Becquerel's discovery of radiating matter and the discovery by the scientists, the Curies, of the fundamental substance, radium.

In our day radiotherapy has acquired such an important position in medicine that one is undoubtedly justified in saying that radiotherapy is one of the greatest gifts which our age has presented to medicine.

I need not, in this gathering, point out the different diseases in which radiotherapy has been employed in the form of roentgen treatment, radium treatment, or sunlight treatment.

What has imparted to radiotherapy its general, and in so many spheres far-reaching importance, is the circumstance and the fact that radiation is capable of supplying the organism with a contribution of energy in its struggle against the morbid process.

Through radiation upon the morbidly changed tissue the disease process is enfeebled, and the normal healing or recuperative forces of the body strengthened, or fresh healing and recuperative powers are produced in the same. This healing influence occurs in such widely different processes as inflammatory conditions of disease, in tuberculosis, in actinomycosis and in leucemic proliferation.

Another characteristic of radiation, which is of general importance to medicine, is its influence upon the endocrine glands, whose action, especially in a morbidly increased condition, by radiation can be reduced and possibly under favorable conditions restored to normal function. Through this influence upon the endocrine glands the radiation is enabled to act upon the entire organism. I need only remind you of its tried influence upon the thyroid gland in the case of Basedow's disease, upon the pituitary gland in acromegaly and upon the ovaries in menorrhagia.

Through its action upon the endocrine apparatus radiation also possesses a chance of influencing the conditions for benign and malignant tumors in the body. In this connection I wish only to remind you of the influence of ovarian radiation upon fibromyomas and upon mammary cancer. It is probable that we are here face to face with fresh possibilities for radiotherapy.

The greatest importance of radiotherapy, however, is attained through direct irradiation of tumors. All other conquests of therapeutics are far surpassed by the fact that for the first time in the history of medicine it has been possible to produce a healing process in malignant tumors, a healing process which in several forms of tumors may bring about a complete healing of the tumor disease without any mechanical removal of the tumor.

From being able at the start to overcome only minor, comparatively benign formations in the skin, radiotherapy now forms an important aid to surgery in the treatment of cancer, and is able in the case of certain tumors to attain better and safer results than surgery.

Thorough and extensive investigations have also made manifest the important fact that a cure of cancer by radiotherapy is as lasting as a cure after a radical operation. On the other hand, radiotherapy with our present technique appears to exercise only a local effect upon tumors, so that a prospect of a permanent cure exists only in the case of locally restricted cancerous tumors.

The advance of modern surgery by asepsis during the last century brought about the establishment of the surgical clinic and the surgical special clinics. The present century has endowed medicine with the radiotherapeutic clinic and the radiotherapeutic special clinic.

The chief cause of the origin of the radiotherapeutic clinic is the definite experience that efficient radiotherapy in the case of malignant tumors is only possible at a clinic and polyclinic especially established for the purpose, in charge of medical men who have been specially trained in this branch of therapeutics and are devoting themselves entirely to it.

Radiotherapy and roentgen diagnosis possess a wide and common basis in the largely joint roentgen physics and roentgen technique. At the public hospitals they also form, for economic and practical reasons, an organic whole under the charge of a medical practitioner trained in both branches of radiology.

As a scientific sphere of research roentgen therapy is, on the other hand, as different from roentgen diagnosis as, for example, heliotherapy in its scientific task differs from microscopic anatomy.

In the earlier stages of development of roentgen diagnosis, when the technique had yet to be developed step by step, the bulk of the work done by roentgenologists was devoted to technical tasks. Roentgen diagnosis in those days could only be called a research method. Since roentgen technique has reached a higher level of development, and since at most places better possibilities for scientific research have been provided, the purely diagnostic

task forms the bulk of the roentgenologist's scientific and practical work.

Medical roentgen diagnosis has developed into a science. It is the science relating to the structure of the human body as it appears on investigation by means of the roentgen ray. Roentgen diagnosis is a branch of normal and pathological anatomy, and is very closely allied to microscopic anatomy.

In the same way as anatomy and pathology, roentgen diagnosis is an auxiliary science of practical medicine. Nevertheless, in their use they occupy a distinct position toward the theoretical medical disciplines, necessitated by the fact that roentgen diagnosis is carried out upon living human beings. The roentgenologist, in his capacity of physician, comes in contact with the sick individual, and his examination must be planned individually with regard to the disease symptoms in every case, and in noting the observations made in the course of roentgen examination. Although roentgen diagnosis in respect to working methods and objects under examination is a branch of anatomy, it forms nevertheless a clinical or polyclinical discipline, which calls for an institution established with regard to the same.

Roentgen diagnosis occupies a distinct position also by reason of the fact that special techniques are required, which in delicate or thorough examinations call for a more complicated and extensive instrumentarium. Roentgen technique has, however, been specialized not only by its instruments but also by the fact that the results of investigation in every complicated instance are entirely dependent upon the planning of the investigation and its consequent performance.

Roentgen diagnosis deviates from ordinary anatomy also by the special character of the roentgen picture. In fact, the roentgen picture forms, as is well known, not a reflection of the outer and inner organs such as they appear to the naked eye when laid bare, but a central projected picture, which at the same time registers the differences in density of the structure of the organ depicted. In other instances, the roentgenogram supplies projected pictures of the inner surface of the hollow organs, after a shadow of the latter has been produced by introduced contrast media.

In many instances the projected pictures of disease processes coincide with the pictures of corresponding changes known to the eye. But in the majority of cases the roentgenogram, in order to supply reliable information, must be carefully analyzed and judged with respect to the technique employed, and with a knowledge of the normal and pathological roentgen anatomy.

The importance of roentgen diagnosis to medical science is undoubtedly at the present day perfectly obvious not only to representatives of medical science but also to every erudite man or woman. Roentgen diagnosis is now indispensable for investigating a large number of diseases. From year to year the duties of roentgen diagnosis are growing greater and greater, and the safety of the results are augmented.

Vast and important fresh tasks await the roentgenologist both within the sphere of roentgen anatomy and roentgen pathology and in clinical roentgen diagnosis. Thus we are only on the threshold of a knowledge of the normal and pathological mechanism of motion of the alimentary canal. As to roentgen anatomy and roentgen pathology of the lungs and heart we have, thanks to the progress of technique, to expect fresh and important knowledge. Through refined and improved methods of investigation by means of contrast agents roentgen anatomy of the urogenital apparatus and the gall-bladder is rapidly developing. Roentgen diagnosis in the sphere of the bony system and of changes in the subcutaneous and subperitoneal connective tissues is about to pass from rough anatomical studies into a science which approaches the borders of histology, since improved sharpness of roentgenograms enables their study in multiple enlargement.

In a still higher degree than radiotherapy roentgen diagnosis has set its seal upon present day medical science. A diagnostic roentgen institute in charge of an expert is a necessary portion of every modern hospital.

By reason of its scientific and practical importance radiology therefore at the present moment is entitled to the independent position in scientific and practical work which accrues to other medical disciples.

It is for us who are radiologists a precious duty in every way to try and make ourselves worthy of the place which we demand for our science. The only way to attain it is by conscientious research and scientific tuition. Teaching and training in radiology have hitherto in most countries not kept abreast of the development of radiology in practical medical science. The organization of training is at the present the main question of radiology, and the chief subject at this world congress.

EDUCATION IN MEDICAL RADIOLOGY

WITH SPECIAL REFERENCE TO THE EXPERIENCE GAINED IN SWEDEN*

BY GÖSTA FORSSELL

That radiology has become a separate department in medicine, and has built up institutions of her own, is due to the practical demands of medical science.

Within the field of medical radiology, research work and the purposeful systematic exploitation of each new experience gained have gradually widened the scope of roentgen diagnosis and radiotherapy to such an extent that these two branches have by now grown into separate, special sciences, each of them widely embracing and exacting enough to claim the full attention and energy of whoever devotes himself—or herself—to its pursuit.

In the same measure as radiology has become more and more indispensable to practical medicine, and as the problems it has been called upon to solve have become both larger and deeper, it has also become more and more evident both to those who represent the practical side of medical science and to the universities, that a *special instruction and training* in radiology is necessary, not only for the physicians who aim to become specialists in that branch, but also for the practitioners in those various branches of the medical profession where radiology plays an important accessory part; and at last it is getting more and more strongly realized that radiology has become so important to medical science as a whole, and so firmly established as a distinct, separate department of that science, that a systematic presentation of the subject should be made a part of the general medical education.

In most countries, the universities have by now given radiology a place, large or small, as a subject of teaching; and each year adds to the number of medical faculties where radiology is recognized as a separate branch of regular medical instruction.

In most countries it is no longer a question whether radiology shall be given a place as a special subject of teaching, but only how that teaching shall be organized.

The question of the best forms of teaching and training in medical radiology is the subject of discussion everywhere.

The practical organization of such instruction can only be arranged with regard to the particular conditions obtaining in each individual country. Thus, the instruction in radiology will have to be planned in correlation with the rest of the country's system of medical education, and with regard also to the organization of nursing there. The foremost factors to be considered are: what competent teachers and instructors can be obtained; how the country stands with regard to scientific and practical development of radiology; and what economic resources are available for the purpose. With regard to all these factors, conditions are exceedingly unlike in different countries, and even in different places within the same country.

If this Congress has decided to make the question of instruction and training in medical radiology the principal topic of its program and work, and has invited the teachers of that specialty from the different countries to contribute the results of their experiences to a joint volume on the subject, it has been done in the hope that the sum of those experiences, reaped by them in the school of practical life, may give us a fuller general view of what particular requirements the instruction in radiol-

*Introductory address before the Second International Congress of Radiology, Stockholm, Sweden, July 23–27, 1928.

ogy are apt to make, owing to the special character of that science; and to find out something about the best forms for such instruction, and what would be, in a general way, the best and most fruitful basis for its organization.

The topic of my own remarks on the subject will be on the manner in which we, here in Sweden, are trying to solve the various problems involved in the task of organizing the teaching of medical radiology.

Since 1914, the Caroline Medico-Surgical Institute in Stockholm has instituted regular courses in roentgen diagnosis and roentgen technique. The courses were optional for the students. Since 1920, similar courses have been instituted at the Faculty of Medicine of the University of Upsala, and since 1923 at the University of Lund.

By a Royal Decree of Nov. 16, 1923, roentgen diagnosis was made a compulsory subject for medical students in all of the Swedish universities, and last year, in 1927, a parliamentary decision made medical radiology a recognized special department of medical education and teaching. Ordinary lecturers in medical radiology were established at the universities of Upsala and Lund, and at the Caroline Institute, where a personal professorship had already been established in 1916, its holder was raised to the rank of an ordinary professor in medical radiology. All the teachers in radiology are at the same time senior physicians in some radiological institution, and have at their side assistant physicians appointed by the university, besides the necessary staff of nurses and hospital attendants. It would be contrary to the ideas and spirit of the Swedish universities to have the scientific work of an important special department directed by men representing some other branch of science, and executed by changing assistants without any special training for their task.

The teaching of medical radiology is arranged in a manner which gives that branch a character entirely of its own within the plan of medical instruction otherwise obtaining in Sweden. As far as other medical subjects are concerned, the university teaching is limited to the general lectures and courses common and compulsory for all the students, while the training in any specialties must be obtained entirely through practical service as assistant physician or amanuensis in clinics and theoretical institutions.

Only with regard to medical radiology does the teaching by the university comprise both the compulsory courses common for all the students and voluntary continuation courses combined with practical exercises, and service as medical assistants for practical training.

Finally, there exists with regard to radiology, more than any other branch, a co-operation in the matter of teaching between the institutions for radiological teaching and the other clinical institutions.

The compulsory course of instruction is given during the early part of the student's clinical terms, after he has seen service for three or four months in some of the large clinics. Its object is to give all the students a systematic presentation of the subject of roentgen diagnosis; that is, of the science dealing with the anatomical structure of the human body as it appears roentgenologically. This course is given in twenty lecture hours during a period of six weeks, and is taken by the student at the time of his clinical service in the medical or surgical department. The number of attendants is from thirty to sixty. The instruction is given in the form of lectures, with demonstration of roentgenograms. Examinations do not form a part of this course as yet; but it is desirable that they should be introduced.

During the students' four years of service in the clinics they have daily occasion to see the demonstration of roentgen findings by the clinical teachers in connection with the clinical lectures and demonstrations, at the same time as they, during their service as clinical assistants, take part in the daily conferences at the central roentgen institute.

The voluntary continuation courses in medical radiology are taken at the end of the student's time of clinical service, shortly bfore the final examinations; consequently, after from eight to ten years of medical study. Their object is partly

to give a presentation of medical radiology as a whole; that is, of the science dealing with the various forms of radiation in the service of medicine; and partly to give some practical training in roentgen diagnosis and technique. They are intended as a preparatory school for those who wish to devote themselves to radiology or some branch of that science, and also for physicians who may be going to take up service in some minor hospital, to which no special radiologist is attached.

The full course occupies about forty-four lecture hours, and extends over two months. It consists partly of laboratory exercises in the interpretation of roentgenograms, partly of lectures with demonstrations—on specially chosen parts of roentgen diagnosis and the elements of radiobiology and radiotherapy. The number of attendants of each continuation course is limited to twelve.

Simultaneously with the course, the students—divided into groups of three—receive practical instruction in roentgenography and roentgenoscopy. For some of them an opportunity is provided to take part, as assistant physicians, in the work at the central roentgen institute of the university.

The problem of special education in radiology is made easier in Sweden by the fact that—thanks to a discerning organization—practically all of the roentgen work in our country is confined to the hospitals, and that, in the larger of these, all of the roentgenological work for the whole hospital is centered in one central roentgen department under the direction of a first-class, thoroughly trained radiologist, who has his entire work—even his private practice—in the hospital.

In the smaller hospitals, the radiological work is confined to roentgen diagnosis, and is taken care of by one of the physicians—either the chief physician himself or one of his assistants—who has had a training in the work.

The practice of roentgen therapy is confined to such hospitals and special departments as possess a radiological clinic headed by a specially qualified radiologist.

The treatment of malignant tumors by radiotherapy is done almost exclusively by two well-equipped radiotherapeutic clinics; one—the Radiumhemmet in Stockholm—for the northern and central parts of Sweden; the other—the Radiotherapeutic Clinic at Lund—for the southern part of the country. A third center of this kind, for the western part of Sweden, is projected, and will be located in Göteborg.

What places the education in roentgen diagnosis in a class of its own is the fact that roentgen diagnosis, on the one hand, as a science apart—like histology, which, as far as the teaching is concerned, is the branch it most nearly resembles—requires teachers and institutions of its own in order to deal with such subjects as roentgen anatomy and roentgen physiology, both as matters of research and of instruction; while, at the same time, it must fill a place as an accessory science to all the other practical and theoretical branches of medicine.

The education in roentgen diagnosis, in Sweden, has to answer a twofold practical purpose: that of providing the most comprehensive and thorough preparation and training possible for the men who are to become chiefs of the central roentgen departments of the large hospitals, that is, the radiologists, and of providing facilities for the specialists in the various branches of medicine to carry out scientific research and to perfect themselves in whatever particular part of roentgen diagnostic work their specialty demands.

The realization of that double purpose has to overcome two difficulties with which the ordinary education in anatomy and pathology does not have to cope, and which are the result of characteristics inherent in the nature of roentgen diagnosis itself. The first one is the fact that roentgen diagnosis is living anatomy whence it results that the roentgenologist, as physician, has to come in contact with the patient. The roentgen diagnostic work must therefore take place right in the clinical hospital, and in constant touch, on the one side, with clinics and polyclinics—on the other side, with the pathological institution.

The second difficulty with regard to roentgen diagnostic instruction and research arises from the economic problem

—from the fact that the scientific conduct of roentgen diagnostic work requires a large amount of very expensive special apparatus, which soon becomes antiquated, besides expensive housing and a large staff of specially trained assistants.

In the special clinics of the large universities abroad it is possible—and perhaps also necessary—to maintain fully equipped special departments for roentgen diagnosis, with roentgenologists and staff of their own. Here, in Sweden, a division of the roentgen diagnostic work in that manner would be impossible on economical grounds alone, and, besides, we hardly believe it to be desirable, either for the scientific work or for the instruction in roentgen diagnosis.

The system we had to create was—as stated above—to serve a twofold purpose. It must provide complete facilities for scientific research and education in roentgen diagnosis as a special branch, and, at the same time, it must offer the best conditions possible for roentgen diagnosis, as an accessory science, to serve the other branches of medicine, both with regard to research and teaching.

We have tried to solve this problem mainly in two ways: partly, by organizing and equipping a central institution of education in radiology in such a manner that it can serve as a special laboratory of research and instruction for all the clinics, and partly, by establishing a steady collaboration with the clinics, both for research and teaching, according to the American system.

In the plans that are being made at present for a new home for all the various departments of the Caroline Institute, the central department of instruction in roentgen diagnosis is placed in the center of the building that houses the medical, surgical, otolaryngologic, ophthalmologic and gynecologic clinics, and comprises three laboratories for routine work, and six laboratories for special research. Beside these, there will be smaller laboratories, both for current work and for special research in connection with the medical, surgical, pediatric and orthopedic clinics, and with the medical polyclinic. Roentgen laboratories are planned in connection with the anatomical, physiological, pathological and medicolegal departments. It is the intention also that the instruction in the theoretical branches of roentgenology shall take place in intimate co-operation with the central department for instruction in roentgen diagnosis.

Radiotherapy is the science that deals with the application of light, in all its various forms, to the service of therapy. It comprises radium therapy, roentgen therapy and heliotherapy.

The special education in radiotherapy derives its peculiar character from the fact that the scientific exercise of radiotherapy presupposes the possession of a scientific training in a number of special disciplines that do not form any part of the ordinary, general medical education, namely, radiobiology, radiopathology and radiophysics. Besides, special education in radiotherapy requires the existence of a special institution, namely, a radiotherapeutic clinic.

Inasmuch as the exercise of radiotherapy in Sweden is practically confined to the central radiological departments of the hospitals, to the radiotherapeutic clinics in Stockholm and Lund, and to a few special departments for radiotherapy—one gynecological and another for skin diseases—the special education in radiotherapy in Sweden has the task of training physicians for these radiotherapeutic institutions.

The instruction is obtained through service—usually for a period of two years—as assistant in the radiotherapeutic clinic of the Radiumhemmet in Stockholm, the radiotherapeutic clinic of the University of Lund, or the central roentgen institutes of the universities.

Previous to entering on this course of radiological training and study, the radiologists have usually done postgraduate service for at least two years either in a surgical or a medical clinic.

The complete radiological training, in diagnosis and therapy, usually requires from four to five years.

After study is ended, the radiologist thus equipped will generally find a position open for him as senior physician in the radiological department of one of the larger hospitals of the country.

The training of teachers in radiology is a very important question. A university teacher in medical radiology should fulfill the same requirements as those for teachers in other disciplines; that is, he should be not only a good practician, but should possess a scientific competence proved by independent scientific production, and he should be able to teach.

In a large attendance at institutions for radiological research and instruction lies the only possibility of developing a sufficient staff of teachers in that branch of medical science. Also in the training of teachers an organized co-operation with correlated medical disciplines is absolutely indispensable.

A necessary condition for the development of education in medical radiology on a scientific basis is that the radiological work in the hospitals out in the country be organized to function in an independent and scientific manner.

If there is to be any meaning at all in starting and maintaining a system of scientific, special education in medical radiology, there must be established, in connection with these hospitals, radiological departments of such a character that radiological work can be carried out in a scientific manner, and will offer the radiologist in charge of such a department an economic situation justifying the long years he has spent in thoroughly fitting himself for the work.

At present, the roentgen departments of Swedish hospitals offer for roentgenologists twenty-two situations as physicians in chief, and six more such places are in the course of being established.

If we look back over the history of radiology, we find that many extraneous circumstances have affected its course. But the deeper we study it, the more do we realize that also here—as is the case with every development—it is the personal forces that have decided the issue right along. The science of radiology has grown up around the ideals visioned by its leaders, and the strongest force for its development has been their deep attachment to their task, their steadfast faith in the future of their science, and in the incalculable services that medical radiology would in ever increasing measure be able to do for mankind.

There is not the slightest doubt that in the future the development of radiology will depend, more than anything else, on the quality of the men we shall be able to enlist for our science. Therefore, if we wish and strive for the advancement of that science, our first and most important effort must be to seek our recruits among those of the young generation who give the greatest promise of becoming leaders in scientific work, and win them to the cause of radiology. We must look and give scope for the interest of the sort of pupils who have the gift of being able to see with their own eyes, and who possess that innate desire for searching deeply into the causes and relations of the phenomena, which we call: the scientific instinct—the scientific mind. They are the ones we must try to win, and to accomplish that, education in radiology is our surest means. Our teaching must be such that it will open the eyes of the young to the problems and possibilities here offered them for work and exploration in a new field of useful science, and such as to make them realize that it is a great thing indeed to devote one's interest, study and life-work to medical radiology.

The end which this Congress has in view is to further the development of radiology and to make the results obtained by radiology bear useful fruit for medical science and service. To achieve that end, no means is more effective than a well-organized education in radiology.

The great interest with which our invitation has been met shows to what extent the importance of this question is realized everywhere. Twenty-three teachers of radiology from different parts of the world have responded to our invitation to present an account of the manner in which the instruction in medical radiology is organized in their respective countries, and to express their views and wishes as to the manner in which that instruction should be further developed. Not all of them will have the opportunity to present to you here today a verbal summary of their experiences, but, as will be seen from the program, their contributions will all

be printed and published together in one instructive volume, which will appear as soon as possible after the conclusion of the Congress.

We hope that this volume will become a "Golden Book" in the history of radiological education, and will be a lasting source of information and incentive to those teachers and authorities on whom the responsibility rests for the organization and future development of instruction and education in radiology.

GROUP TREATMENT OF CANCER

To the Editor:

A recent article in the *Journal of the American Medical Association* based on a tabulation of methods employed in the treatment of malignancy in a group of middle-sized American cities led chiefly to the conclusion that the best cancer statistics in this country at the present time are being obtained by groups which are avowedly formed to conduct cancer centers.

The term itself, "cancer center," seems to imply institutional work; full time or at least permanent part time connection of the members of the group with an institution; probably an endowment and possibly the confinement of its activities to charity or semi-charity patients.

It seems to the writer that there exists in every American city of any size the material, physical and human, for handling the cancer problem as well as we are now able to handle it without the need of institutional backing, without the need of an endowment and without being under the necessity of confining its activities to the institutional type of patient.

Most, if not all, middle-sized or larger American cities have adequate supplies of radium which, if need be, could be augmented. Practically all of them have the physical facilities for modern roentgen therapy. Practically all of them contain specialists sufficiently qualified in surgery, radiology and pathology to provide the human material. There remains only the difficulty of working out a plan whereby the individual interests of the potential members can be pooled so that all may derive suitable benefits, material and otherwise, and so that the best interests of the patient may actually be served without interference through any personal conflicts on the part of individual members of the group.

The following paragraphs are offered as the nucleus of such a plan and it would appear to the writer that this plan could be worked out quite compatibly with the individual interests of the members, the association to be confined entirely to the handling of cancer cases of the types indicated. In other words, the plan implies no community of other interests, no necessity of common office quarters, and while it would undoubtedly be desirable, it is not absolutely necessary that all of the members of the working unit should be associated with the same hospital.

I should be extremely interested in hearing from readers of the Journal who may have contemplated, or better, who have tried some such working plan of attack on cancer. It is obvious that if any new method of approach to the cancer problem which does not involve irradiation were to dominate the field, this scheme would no longer have any merit. It is assumed, however, that the only new method now in sight which seems to offer considerable possibilities—some future development of the colloidal lead therapy—remains within the joint field of the surgeon and the radiologist.

THE PLAN

At the present, the best chance for success in dealing with cancer, meaning malignancy of the breast, female pelvis and other less common forms of malignancy which are deeply situated and in which some known program promises a certain percentage of cures or satisfactory palliation, lies in a group handling, somewhat akin to that employed in the so-called cancer centers.

The group, as a minimum, should consist of one or more surgeons, a radiologist and a pathologist.

In order to achieve a fair percentage of satisfactory results it is necessary, for the

purposes of this work, that the personalities of the individual members be more or less submerged in the group identity so that no considerations of a personal character shall influence the plan of treatment in any way.

The agents employed, surgery, radium and roentgen rays, should be considered as complementary and not as individual factors. It is necessary that one or two or all three should be employed without prejudice and without any preconceived order in their employment, this being dictated by the exigencies of the individual case.

It follows that cases should be seen and studied by all members of the group *prior* to the institution of any treatment and that the plan of treatment chosen should represent the combined judgment of the group.

As a corollary to the above it is essential that the patient be made to understand that he cannot elect to take only such part of the prescribed treatment as appeals to him and that he will not be permitted to stop, short of going through the whole program outlined for him. It must, in fact, be made clear to him that he is not receiving treatment at the hands of the radiologist or the surgeon as a distinct therapeutic entity, but that the initial treatment implies irrevocably that the remainder of the program is to follow.

Such a plan rigidly adhered to and followed through with no interference arising from questions of ego on the part of any of the members or proprietorship in the patients is responsible for the better results achieved in so-called cancer centers than are usually obtained in private work.

Individuals in private practice not associated with any institution could, for the purpose of handling cases of this type only, form a working group for the treatment of malignancies of the type indicated with a prospect of results as good as those achieved by cancer centers provided their individual qualifications were sufficiently high and their physical equipment adequate.

Such a working agreement, if faithfully carried out, should result in a marked increase in the number of cancer cases coming under treatment by the group and would in time result in such cases being seen earlier and consequently in still further improving the end-results achieved.

C. D. ENFIELD.

A CORRECTION

To the Editor:

I have received a letter from Dr. Hickey calling my attention to the fact that I incorrectly quoted him (p. 212) in a recent article[1] regarding the distinction between the adult male and female larynx. I am inclosing the paragraph in which Dr. Hickey explains the above distinction. Will you please make note of Dr. Hickey's correction in the Journal.

"I am very sorry that you misunderstood me about the distinction between the larynx of the adult male and the larynx of the adult female. This distinction follows the well-known anatomic distinction between the male and female larynx. In the adult male larynx the principal lime deposit after the age of twenty-five is in the thyroid cartilage, with a minimum deposit in the cricoid. In the adult female larynx the principal deposit of lime is in the cricoid cartilage, with a minimum deposit in the thyroid. This usually enables one at a glance to differentiate between the male and female larynx."

Yours very truly,
SAMUEL BROWN.

[1] Brown, Samuel, and Reineke, Harold G. The roentgenological study of the neck. AM. J. ROENTGENOL. & RAD. THERAPY, September, 1928, XX, 208–212.

Vol. XX, No. 5

DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

A VERTICAL ROENTGENOGRAPHIC UNIT

ROENTGEN EXAMINATION OF THE HEAD AND OTHER PARTS OF THE BODY IN THE UPRIGHT POSITION

BY SIDNEY ISRAEL, M.D.

HOUSTON, TEXAS

At the present time the usual method employed to produce roentgenograms of the head, accessory sinuses, or mastoids is with the subject in a horizontal position on a table; or in lieu of this position, sitting with the head bent or flexed so as to adapt it to certain requirements in order to obtain the essential angles of position.

Both of these positions possess certain well-known disadvantages or objections, especially when dealing with elderly or stout persons, with short and fat necks. Children also are frequently easily frightened and difficult to examine when placed on a table, face down beneath a mass of apparatus suspended from above.

The apparatus herewith described permits a roentgenogram to be made of any patient able to sit or stand—the upright position being the same essentially as one would assume in having a photograph made, except with the back turned. It affords rapid placing of the patient in position, ease and comfort during exposure and with a minimum of floor space necessary for its installation.

With this upright apparatus one can likewise, with the greatest facility, roentgenograph practically the entire body. The ease of obtaining a true lateral view of the chest with the arms extended above the head and the cassette placed high up in the axilla is readily recognized and demonstrates the flexibility and latitude of the apparatus for various uses (Fig. 9).

Figure 1 is a view of the entire apparatus. The two upright or vertical posts are 76 inches high and spaced 19 inches apart. To these vertical posts are attached two horizontal crosspieces. These crosspieces are adjustable and can be locked at any desired location; they can be moved toward or away from each other, so as to accommodate any cassette, ranging in size from 5×7 to 14×17 inches. There is a channel guide in which the cassette slides

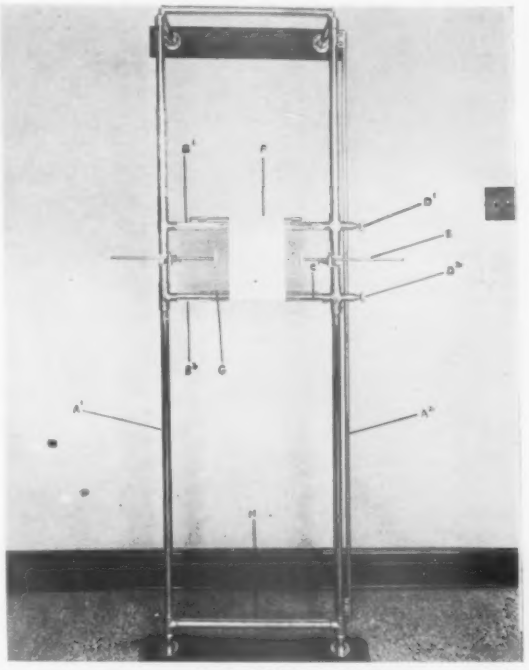
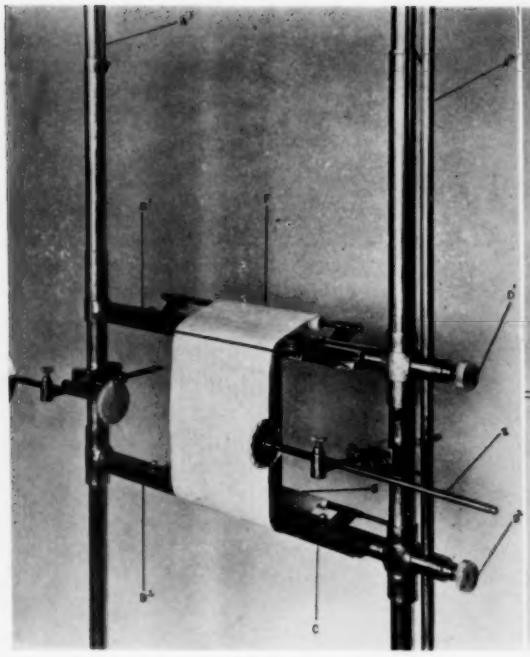


Fig. 1. A^1–A^2, vertical hollow uprights, containing counterbalanced weights; B^1–B^2, horizontal crosspieces to which is attached C, channel guide to hold cassette; D^1–D^2, lock nuts for B^1 and B^2, allowing horizontal crosspieces to be set at any height, from top to bottom of vertical uprights and adjustable so as to accommodate a $5 \times 7''$ or $14 \times 17''$ cassette; when so adjusted to move as one to any desired level; E, removable head clamps; F, sanitary paper roll; G, rewind for soiled paper; H, foot rest. The entire apparatus projects from the wall 9 inches and is counterbalanced, permitting of easy and rapid adjustment.



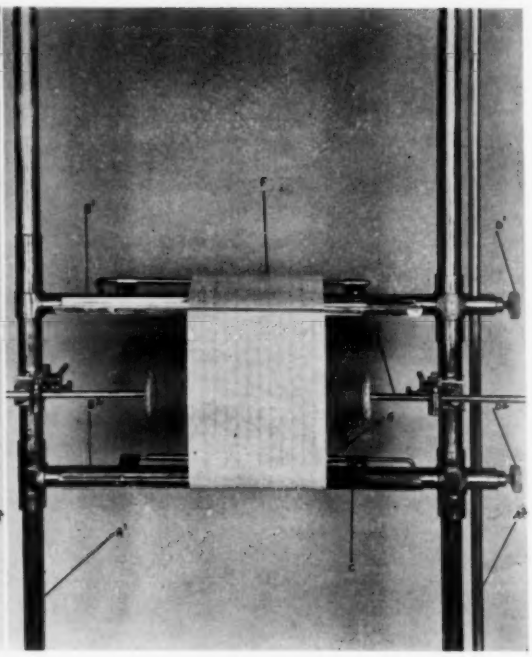


Fig. 2. Fig. 3.

Figs. 2 and 3. Close-up view of essential working parts of Figure 1.

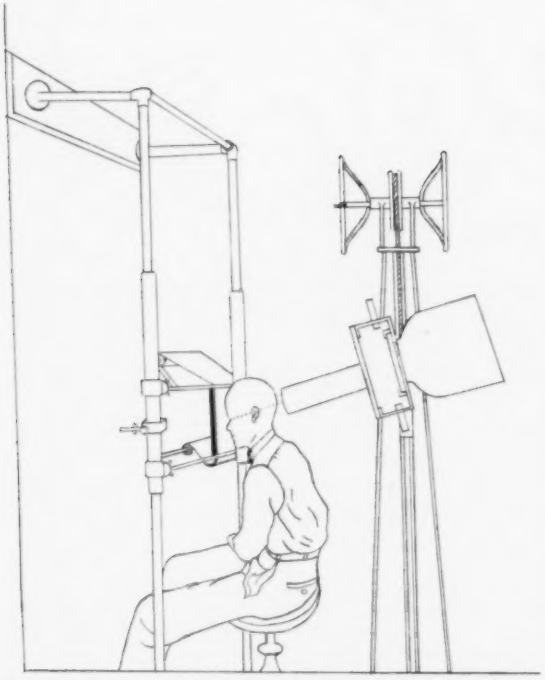


Fig. 4*a*. Schema showing frontal, ethmoid and sphenoid positions, with central focus of the ray through nasofrontal articulation in upright position; nose and forehead on cassette.

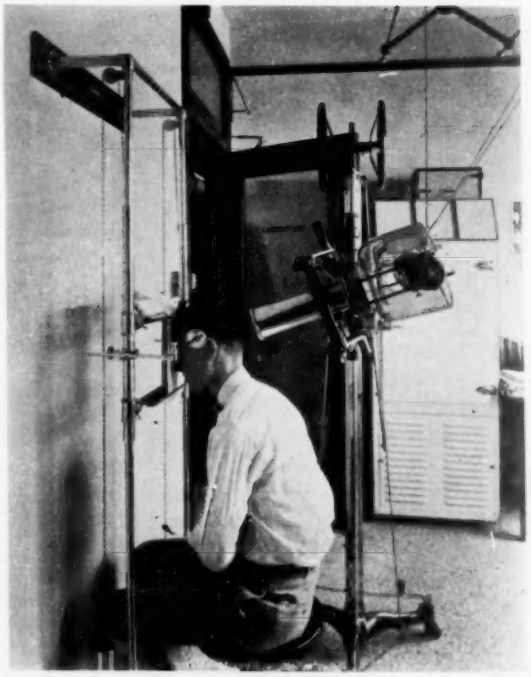


Fig. 4*b*. Photograph of frontal, ethmoid and sphenoid upright position.

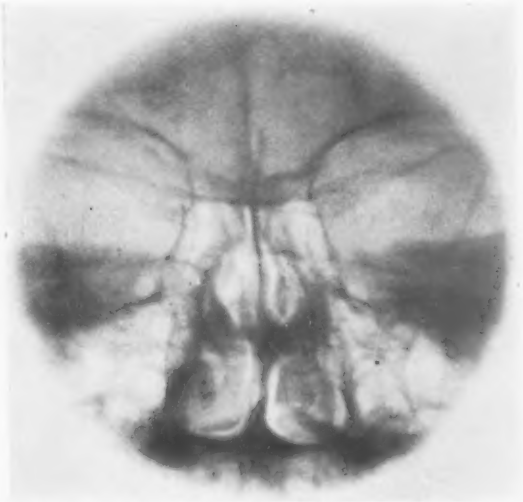


Fig. 4c. Roentgen visualization of results obtained in upright position of Figures 4a and 4b.

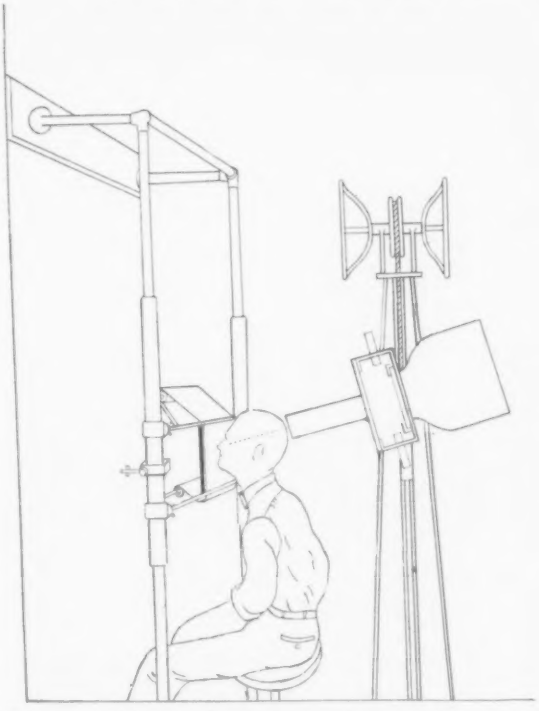


Fig. 5a. Schema showing upright maxillary sinus position. Central ray directed through a line ½ inch beneath outer angle of eyelids. Chin and nose resting on film cassette.

and is held in position. The horizontal crosspieces are counterbalanced and can be moved as one, holding the cassette at the desired level opposite the site to be examined. The apparatus is so constructed that the horizontal crosspieces can travel

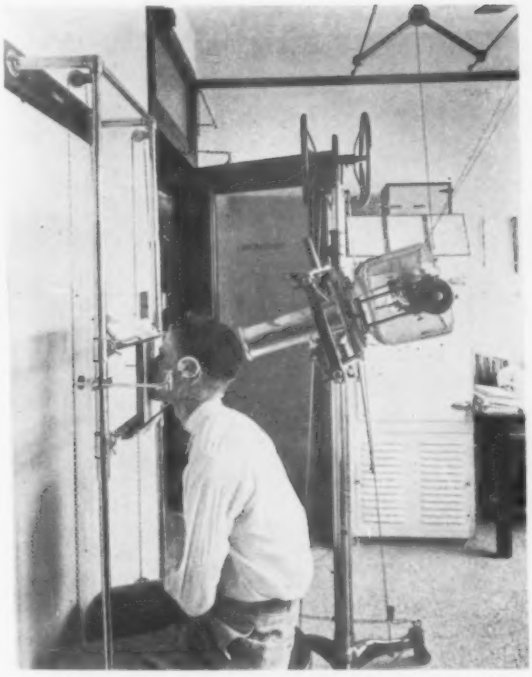


Fig. 5b. Photograph of upright maxillary sinus position.

from the floor to the top of the vertical parts, locking at any given elevation.

There is a paper roll which supplies a sanitary surface on the cassette for each patient's face, after each exposure. Head clamps that are easily and quickly removed or adjusted are utilized and likewise move as a unit with the horizontal crosspieces.

A simple attachment to the horizontal crosspieces permits one to utilize a Potter-Bucky diaphram, and a cassette holder for the purpose is also employed for rapid stereoscopic views.

The entire apparatus projects from the wall 9 inches.

FOR THE VISUALIZATION OF THE FRONTAL SINUSES, ETHMOIDS AND SPHENOIDAL SINUSES IN THE POSTEROANTERIOR POSITION

The patient sits on a stool with the nose and forehead resting on the paper shield covering the film cassette, 5 × 7 inches. The head clamps prevent mobilization. The central ray is directed through the root of the nose or the nasofrontal articulation.

This position and technique projects the frontal sinus and ethmoidal cells on

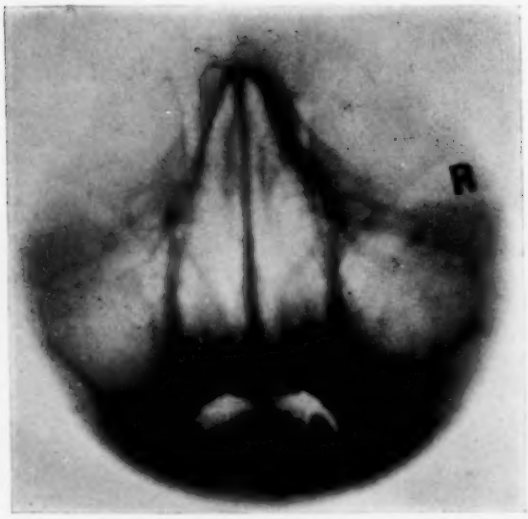


Fig. 5c. Roentgen visualization of results obtained in upright maxillary sinus position—Figures 5a and 5b.

the film with the sphenoidal sinus slightly below the ethmoids, to avoid overlapping or masking one by the other (Figs. 4a, 4b and 4c).

Fig. 6a. Showing upright position obtaining lateral view of head.

Fig. 6b. Showing lateral view of frontal, ethmoids, sphenoidal and maxillary sinuses, in upright position.

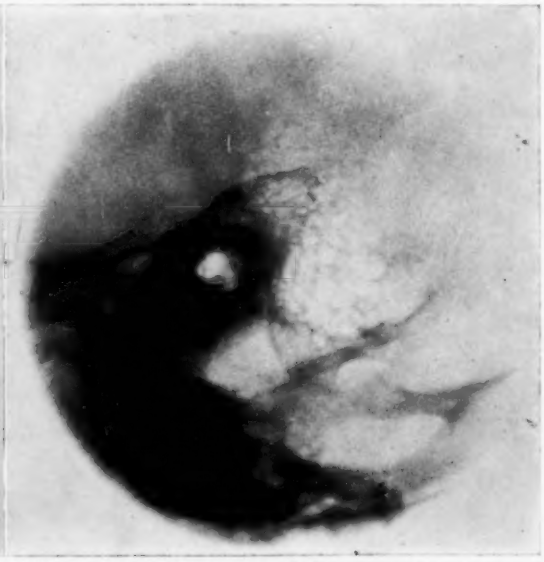


Fig. 7. Roentgenogram of right mastoid, with patient in upright sitting position.

THE MAXILLARY SINUS POSITION: POSTERO-ANTERIOR

Chin and nose on film cassette, head clamps for immobilization, central ray directed through a point ½ inch below external angle of eyelids.

The projection on the film shows an uninterrupted view of the maxillary sinuses, with the petrous portion of the temporal bone out of the way and below the level of the floor of the sinus (Figs. 5a, 5b and 5c).

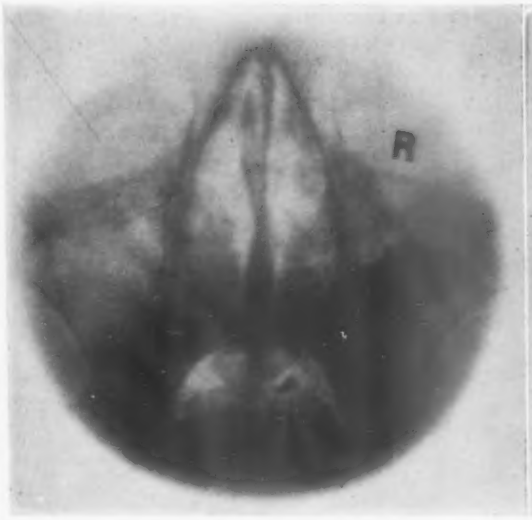


Fig. 8a.

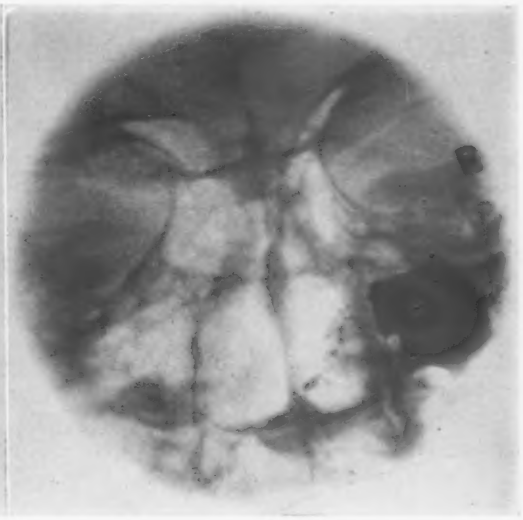


Fig. 8b.

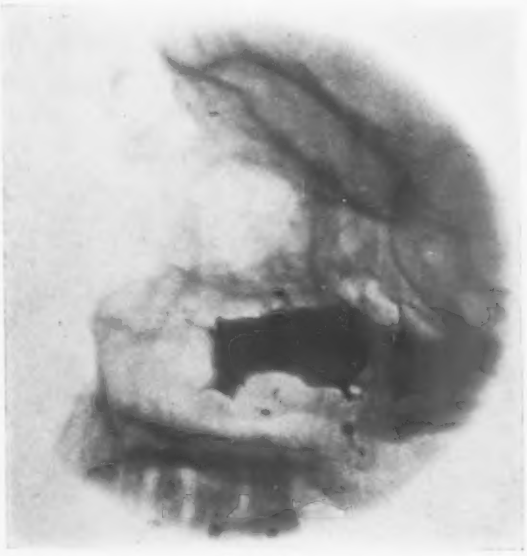


Fig. 8c.

Figs. 8a, 8b and 8c. Lipiodol injection of right maxillary sinus. The level line or summit of the fluid is clearly demonstrated, also the irregular outline of the fluid content brought about by the alteration in the mucosal lining of the sinus. Clinical diagnosis—chronic maxillary sinusitis.

With this apparatus and technique of focusing the central ray of the tube, the pyramid or petrous portion of the temporal bone is always projected below the level of the maxillary sinus, with a minimum of sinus distortion.

This upright apparatus and position is the only means whereby it is possible to demonstrate the level line (Figs. 8a, 8b and 8c) when the sinus contains fluid or pus.

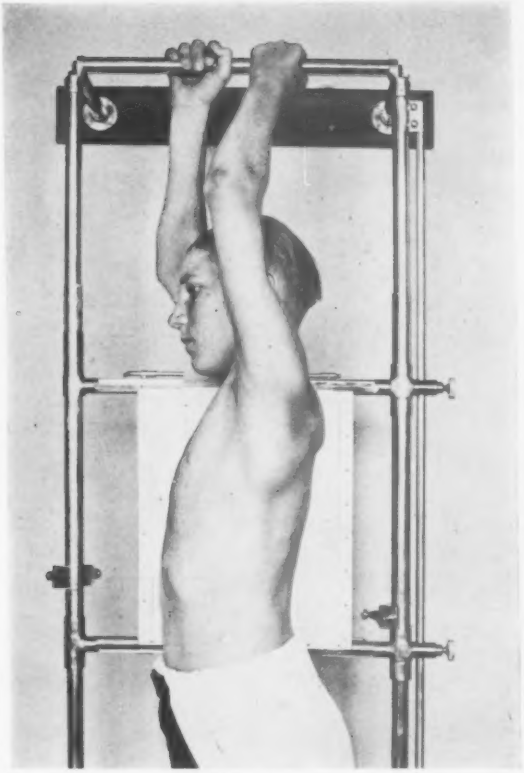


Fig. 9. Photograph of patient, showing true lateral position to be obtained with upright apparatus, with film cassette placed high up in the axilla and patient resting comfortably against cassette.

With the upright apparatus as herewith

described the positions are quickly obtained. It is my opinion that fixed or arbitrary angles for roentgen-ray visualization of the accessory sinuses are of limited value for the following reasons: (1) The development of the head, facial contour and features vary practically with each individual and because of these variations, when roentgenograms are made at fixed or arbitrary angles, the end results when seen on the film also vary and are frequently unsatisfactory; (2) the anatomical relationship of the nasofrontal articulation or root of the nose, with the location of the frontal sinus, ethmoidal cells and sphenoidal sinus is always the same, and serves as the surface landmark for the central focus of the ray by which is obtained satisfactory visualization of these sinuses on the film, with a minimum interference from overlapping. With the nose and forehead resting on the cassette, a satisfactory roentgenogram is dependent neither on the size nor shape of the head, nor differences in facial contour, provided the central ray is directed through the root of the nose.

Any method that permits of rapidity and ease in placing the patient in the desired position, together with the uninterrupted or unmasked projection of the sinuses on the film or plate, uninfluenced by differences in facial contour or development, and occupying a minimum of floor space, approaches the ideal.

Visualization by means of the roentgen ray of the accessory sinuses of the head and mastoids can be of inestimable value.

The method employed in production and skilled interpretation are the chief requisites in order to avoid the frequent pitfalls of misleading information resulting from lack of these essentials.

The study[1] of the microscopic and surgical pathology of paranasal sinus disease during the past four years, together with the operative and comparative roentgen findings in each case, has stimulated this investigation and strengthened my opinion that the criticism frequently directed against the value of the roentgen ray when employed for sinus diagnosis is without substantiating fact.

The upright apparatus is the result of this knowledge of sinus diagnosis and the requisites. Because of the ease and rapidity and ability to produce identical and accurate roentgenograms in each or the same case, the upright apparatus has been of untold value in our daily routine.[2]

[1] Israel, S. Chronic disease of the maxillary sinus; diagnosis and surgical treatment. *Arch. Otolaryngol.*, June, 1928, vii, 565–579.

[2] Since the first presentation of my apparatus by means of motion pictures, May, 1927, in Atlantic City, Dr. Willis F. Manges has described (Apparatus for Making Roentgenographic Examinations of the Head. Am. J. Roentgenol. & Rad. Therapy, February, 1928, xix, 166–169) an apparatus showing a similar line of thought and the superiority of the upright position for roentgenographic examinations of the head.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

Lenk, Robert. Roentgen diagnosis of coronary sclerosis *in vivo*. On the detectability of aneurysm of the heart in the roentgenogram. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1927, xxxv, 1265–1268.

A clinically obscure case in a man, aged sixty-eight, revealed on roentgen examination from various angles the presence of a large aneurysm of the heart at the anterior wall of the left ventricle. A Bucky roentgenogram of the heart showed two parallel shadow bands that can be explained only as a calcification of a branch of the left coronary artery, probably of its horizontal ramus. This is apparently the first case of coronary sclerosis detected roentgenographically. By the use of the Bucky diaphragm and short exposures, it is believed possible to diagnose sclerosis of the coronary arteries with no more difficulty than that of peripheral vessels. This represents a new field for the application of roentgen diagnosis.

Levyn, Lester, Beck, Edgar C., and Aaron A. H. Cholecystography in the late months of pregnancy. *Radiology*, July, 1928, xi, 48–55.

In a group of 17 primiparas, the authors found that the intravenous injection of tetraiodo had no harmful effects on the mother or fetus and did not affect the course of pregnancy. In 7 cases the gall-bladder failed to visualize in otherwise normal women. In 10 cases in which there was normal visualization, the concentration of the dye and the Boyden meal response were normal. In all these cases, the gall-bladder occupied a position high in the abdominal cavity. Morning sickness occurred more often in those patients in whom the gall-bladder did not visualize. It is recommended that during the entire course of pregnancy a properly balanced fatty meal be taken daily to stimulate emptying of the gall-bladder and prevent stagnation of the bile.

Lockwood, I. H., and Skinner, E. H. Cholecystography. *Radiology*, July, 1928, xi, 7–12.

The authors have summarized their experience in a series of 1,500 cases in which cholecystography was employed, with special reference to pernicious anemia, myocardial degeneration, infectious arthritis and gastric acid content. Plain negatives made in two projections preceded administration of the dye, and then the method is as follows: following cleansing enema and noon meal rich in fats and cream, followed at 6 P.M. with tea and toast without butter or cream, capsules were given at 8 P.M. in four doses fifteen minutes apart, the patient being cautioned not to break the capsule in the mouth. Twenty grains of sodium carbonate were given just preceding the capsules. One grain of dye per each five pounds bodyweight was given smaller individuals, while one grain per four pounds was given the heavier patients. No food was taken the following morning before roentgenograms were made. The authors found no contraindications to administration of the dye and it was given with perfect impunity even to pregnant women and nursing mothers.

Of the 1,500 cases, 610 proved pathologic. Of these 610 cases, 278 showed no shadow of the dye in the gall-bladder. Of the total number of pathologic cases, 192 were operated on and in only 7 instances was an incorrect preoperative opinion given,—96.4 per cent accuracy in diagnosis. This method is commendable not only on account of the good results obtained, but also because of the lack of discomfort and harm to the patients. The total absence of any concentrated gall-bladder shadow should indicate a pathologic condition, but without clinical symptomatology to corroborate these findings, and negative roentgen-ray studies of the gastrointestinal tract, should lead to re-examination. Forty-eight of the no-shadow cases were re-examined without any change in the cholecystogram. The reduction of the filled gall-bladder after a fatty meal may be regarded as an index of function. In pernicious anemia, 70 per cent showed pathologic gall-bladders, 39 per cent showing stones. In myocardial degeneration, 71 per cent showed gall-bladder pathology and electrocardiographic findings. There were also cases of myocardial degeneration with gall-bladder symptoms but with normal cholecystographic findings. One hundred and sixty-eight cases showed definite evidence of infectious arthritis, 69 per cent of these showing pathologic gall-bladders with 15 per cent showing stones.

Löweneck, M. A few unique observations of pathology in the esophagus. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1927, xxxv, 1230–1233.

Three cases are described. The first was one

of dysphagia lusoria with a high right sided position of the aorta. This occurred in a man aged fifty-six, suspected of gastric carcinoma. Examination of the passage of contrast material through the thoracic region showed a peculiarly outlined middle shadow. The aortic button was absent, while the pulmonary artery and the left ventricle were in their usual positions. On the right, very closely below the sternoclavicular joint, a small shadow was visible which passed like a band downward and turning left disappeared into the central shadow at the level of the right auricle. Rotation of the patient in the first oblique diameter disclosed the aortic arch connecting with the ascending and descending vascular band. This visibility through the aortic arch was also obtained in the second oblique diameter. Contrast filling of the esophagus at the level of the aortic arch showed the former to be bowed to the left and front. This displacement of the esophagus was most pronounced in the first oblique diameter and invisible in the second. The conclusion from the roentgenoscopic observations was that the aorta originated at the normal point but that the ascending limb, instead of turning toward the left to form the arch, turned sagittally toward the back against the right boundary of the spinal column; the descending branch followed the latter until nearly above the diaphragm it passed diagonally to the left and thence assumed its normal course. As regards the condition in the esophagus, no inflammatory or neoplastic process could be demonstrated anywhere in that region and the diagnosis therefore was high right sided position of the aorta, and dysphagia lusoria; corresponding to the transposed position of the aorta, the subclavian artery running behind the esophagus forced the latter forward. Autopsy confirmed this diagnosis.

The second case occurred in a man, aged forty-three, complaining of pressure under the left ribs extending from the left boundary of the sternum to the mammillary region. The heart and lungs offered no explanation for the symptoms. Contrast meal in the esophagus disclosed at the level of the bifurcation a rounded sac the size of a hazelnut hanging by an oblique narrow passage and apparently pointing toward the left main bronchus. For a distance of 3 cm. orally from the origin of the sac, the esophagus was drawn forward slightly toward the sternum and immediately below made a blunt angle to assume its ordinary course. There was no hindrance to passage of the meal. This case was diagnosed as an epibronchial traction-pulsion diverticulum. Apparently inflammation originating in the glands of the bifurcation involved the anterior wall of the esophagus, and on recovery developed adhesions drawing the latter forward. The internal pressure in the esophagus tended to support this process, pushing forward the weakened section of the esophagus wall, widening it and resulting in a pocket-like structure.

The third case was a diaphragmatic hernia in the esophageal hiatus occurring in a man aged thirty. This patient had undergone gastric resection for ulcer but the diaphragmatic hernia seemed not at all connected with this factor, since a previous roentgen examination had shown the same picture of diaphragmatic hernia, but at that time was interpreted as being an epiphrenal diverticulum. Operation confirmed the recent roentgenological diagnosis. The esophageal hiatus near the esophagus was wide enough to permit the passage of two fingers. Closure of the hiatus has resulted in relieving the patient of symptoms.

McGraw, Arthur B. Juvenile exophthalmic goiter. *Surg., Gynec. & Obst.*, July, 1928, xlvii, 25–31.

Juvenile hyperthyroidism is apparently identical in its symptoms, course and response to treatment to the adult syndrome known as exophthalmic goiter. Cases of juvenile hyperthyroidism are, in the present state of our knowledge, primarily surgical problems, and the sequence of events in their care should be rest, the administration of iodine, operation, rest and observation under surgical supervision. While there is doubt that the polar ligation of the superior thyroid arteries is a sufficiently radical procedure to ensure a permanent recession of symptoms, the author feels that one should be slightly more conservative in the relative amount of thyroid tissue left behind at operation as compared with that left in cases of adult exophthalmic goiter—even risking the necessity of subsequent re-operation, until there is on hand a body of accurate data on the effect of subtotal thyroidectomy upon human growth and development.

Two cases are reported in detail and, in addition, the author summarizes a review of the literature on the subject.

Mayer, Ernst G. Roentgenographic examination of the base of the cranium in the presence of basal tumors. Technic and method of diagnosis. *Radiology*, April, 1928, x, 319–341.

The technique of examination and the principal changes to be observed as caused by tumors in various sites are summarized as follows:

1. Suspected tumor of the posterior fossa:
   A. Technic of examination.

1. The lateral general roentgenogram (survey).
2. The sagittal general roentgenogram (survey (anteroposterior).
3. Roentgenogram of the temporal bone after the Stenvers method.

B. Important changes from the standpoint of diagnosis.

1. Changes due to increase of pressure:
   a. Thinning of the squama.
   b. Dilatation of the internal auditory canals.
   c. Dilatation of the sella turcica, associated with hydrocephalus of the third ventricle.
2. Local changes caused by the tumor:
   a. Thinnings or hyperostoses of the squama.
   b. Dilatation of the internal auditory canal.
   c. Erosion of the apex of the pyramid.
   d. Erosion of the dorsum sellæ.

II. Suspected tumor of the middle fossa:

A. Technic of examination.

1. Lateral general roentgenograms (surveys).
2. Sagittal general roentgenograms (surveys) (postero-anterior).
3. Roentgenogram of the temporal bone after the Stenvers method.

B. Important changes from the standpoint of diagnosis.

1. Changes due to increase of pressure:
   a. Dilatation of the sella turcica, associated with hydrocephalus of the third ventricle.
   b. Acumination of the apex of the pyramid.
   c. Erosion of the subarcuate fossa.
   d. Erosion of the small wing of the sphenoidal bone.
   e. Widening of the foramina.
2. Local changes caused by the tumor:
   a. Erosion of the body of the sphenoidal bone (sella turcica).
   b. Erosion of the pyramid.
   c. Erosion of the thickened portion of the great wing of the sphenoidal bone.
   d. Erosion of the thickened portion of the small wing of the sphenoidal bone.
3. Obscuration of the ethmoid cells or the sphenoidal sinus.

III. Suspected tumor of the anterior cranial cavity:

A. Technic of examination.

1. The lateral general roentgenogram (survey).
2. The sagittal general roentgenogram (survey) (postero-anterior).
3. Roentgenogram of the orbit after the Rhese-Goalwin method.

B. Important changes from the standpoint of diagnosis.

1. Changes due to increase of pressure:
   a. Dilatation of the sella turcica, associated with hydrocephalus of the third ventricle.
   b. Pressure erosions of the small wing of the sphenoidal bone and of the frontal bone.
2. Local changes caused by the tumor:
   a. Erosions and hyperostoses of the small wing of the sphenoidal bone (optic canal).
   b. Erosions and hyperostoses of the frontal bone.

Milani, E. Two chapters in the roentgenology of the heart: congenital anomalies and changes in the rhythm of the heart. *Radiol. med.*, July, 1928, xv, 693–735.

Case histories and many illustrations are given of the different groups of congenital anomalies of the heart. The roentgen diagnosis of congenital lesions is relatively easier, the older the lesion and the longer it has permitted the patient to live; but the adaptations which the heart is necessarily obliged to undergo make the interpretation of the roentgen signs difficult, and the diagnosis can be made only from combined clinical, roentgen and electrical examination and not always even then. But often even in the most complicated cases a probable diagnosis can be made, while in congenital anomalies in infants only a few days or a few weeks old roentgen diagnosis is very difficult and is often not confirmed by the anatomical findings because of the complexity of the associated lesions.

In the other chapter of roentgenology of the heart discussed, that of change in the rhythm of the heart, roentgen examination must be associated with electrocardiography; by these combined methods of examination disturbances of rhythm can often be diagnosed accurately.

Nenassi, E. Roentgen diagnosis of dermoid cyst. *Radiol. med.*, July, 1928, xv, 677–683.

Three cases of ovarian cyst are described, in none of which a diagnosis of cyst had been made from the clinical symptoms. The probable clinical diagnosis in the first case was tumor of the mesenteric or retroperitoneal lymph glands or a sacculated chronic peritonitis; in the second case the clinical symptoms were those of abdominal tumor, and vaginal

examination seemed to indicate a fibroma of the uterus, and in the third case the probable diagnosis was fibroma or tumor of the lymph glands. Roentgen examination showed dermoid cysts in all of these cases. The diagnosis of dermoid cyst was made from the presence of teeth in the cysts and the site and length of the pedicles were indicated by the areas of greatest pressure on the intestines. These cases show the value of roentgen examination in differentiating dermoid cysts from other cysts of the ovary; it is practically impossible to make a differential diagnosis between dermoid and mucus cyst of the ovary without roentgen examination.

Newcomer, N. B., Newcomer, Elizabeth, and Conyers, Chester A. Conclusions based upon the routine intravenous administration of sodium tetraiodophenolphthalein in gall-bladder diagnosis. *Radiology*, July, 1928, xi, 56–71.

The routine use of sodium tetraiodophenolphthalein in a series of about 400 cases has proved to the satisfaction of the authors that this dye is safe, extremely accurate in estimating the amount of pathology present in the gall-bladder and is received with favor by patient, physician and surgeon. The intravenous method is considered one of the greatest advances in medical science in years. This series is divided into four groups according to the results obtained and on which diagnosis was based. A detailed discussion of the results, interpretation and accuracy of diagnosis are given.

O'Brien, Frederick W. Elevation of the diaphragm. *Radiology*, March, 1928, x, 226–233.

Elevation of the diaphragm is of considerable clinical significance in diagnosis. Because of the ease with which the diaphragm can be studied in roentgenograms, the author has made extensive use of this method of determining the extent of changes in the lung cavity. It is of much diagnostic significance in subphrenic abscess and diaphragmatic hernia. Temporary elevation of the diaphragm occurs in pneumonia, lung abscess, subphrenic abscess, diabetes, Banti's disease, during digestion and normally at full expiration. Permanent elevation of the diaphragm is seen in eventration, unoperated-upon diaphragmatic hernia, mediastinal tumor, aneurysm, chronic tuberculosis and any condition with permanent involvement of the phrenic nerve. In making this examination, both the roentgenoscopic and roentgenographic methods should be used. The author then gives a description of the contour of the diaphragm in some of the above conditions and offers the proper interpretation to be placed upon them.

Oakman, Carl S. Correlation of cholecystography and the barium meal. *Radiology*, July, 1928, xi, 27–33.

A series of 305 consecutive cases in which both cholecystography and the barium meal were used are reported, the barium meal being included because 25 per cent of dye-filled gall-bladders may have pathology which may be missed unless other means of diagnosis are employed. Of the 305 cases studied, 162 were diagnosed as gall-bladder pathology; the diagnosis was proven to be correct in 97.3 per cent of the cases coming to operation. Gallstones were detected in only 13.6 per cent of the cases reported as gall-bladder disease. Of the 143 cases showing no gall-bladder pathology, there were 20 which showed normal cholecystogram, with "indirect" evidence, indicating pathology elsewhere than in the gallbladder. Of the 305 cases recorded, 68 were negative for any pathology by roentgen-ray examination. These findings are encouraging from the standpoint of accurate diagnosis, since 97.3 per cent of the cases coming to operation were correctly diagnosed by this method as compared to 53 per cent by the old methods.

Ormond, John K. Pyelography. *Ann. Clin. Med.*, 1927, v, 720–737.

The use of pyelography over so many years has rendered the interpretation of the pictures obtained pretty well standardized, although there are certain points of controversy and certain borderline or unusual pictures in which the diagnosis is uncertain. However, in most pyeloureterograms the interpretation is not obscure, and the method has proved its usefulness and is now an indispensable procedure in the diagnosis of the whole field of renal and ureteral lesions.

There are early cases in which the pyelogram is difficult to interpret and certain cases may present features simulating those given by malignant growths. In such cases repeated pyelograms over a period are necessary. Even with this aid few cases of the malignant renal tumors are diagnosed early enough for cure. The appearance on the pyelogram of tumors differs according to whether the tumor is in the parenchyma or in the pelvis. A papilloma of the pelvis gives a filling defect, while a tumor in the parenchyma gives a completely disordered distortion. Usually the calyces are drawn out into odd shapes and are usually much narrowed, forming the so-called spider-like calyces. In cases of hematuria having an

origin in the upper urinary tract, pyelography will usually make the diagnosis between tumors, polycystic kidney, ureteral stricture, tuberculosis, etc. In renal tuberculosis the diagnosis can usually be made without the use of pyelography, but there is a definite place for the latter in the diagnosis of tuberculosis. It may point the investigator to a correct diagnosis in cases in which tuberculosis has not been suspected. The pyelogram in tuberculosis is fairly characteristic; usually the pelvis is small, although in long-standing cases of tuberculous ureteral stricture there may be a superimposed hydronephrosis. There is usually evidence of a cavity in the parenchyma emptying into one of the calyces or there is a fuzziness of outline of one or more calyces. In polycystic kidney the pyelogram may be quite characteristic, the cysts causing rounded encroachments on the pelvis and calcyes. In the diagnosis of hydronephrosis, pyelography is indispensable. The larger ones can be diagnosed without its aid, but the smaller ones with almost normal junction, which are at the same time the source of vague symptoms, are almost entirely dependent on pyelography for their diagnosis and for guidance as to their treatment. The diagnosis of stricture of the ureter is made by the pyelogram, combined with other evidence. This is a subject on which there is much controversy, and authorities differ in the interpretation of the roentgen findings and of their significance.

The congenital anomalies, ectopic kidneys, horseshoe kidney, reduplication and particularly branching of the ureter would often be undiagnosed if it were not for the use of the pyelogram. Finally, pyelography aids in the diagnosis of renal calculi. Seventeen illustrative pyelograms are presented.

Pförringer. A case of unusual bone new growth following gunshot fracture. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1927, xxxv, 1234–1236.

A description is given of a case of myositis ossificans occurring in a soldier thirty-two years old, after gunshot fracture of the upper arm. A roentgenogram at the time of injury showed a fragmented fracture in the middle of the upper arm with dislocated fragments distributed in the neighboring soft tissues. Three years later the roentgenogram showed an enormous new bone development beginning at the surgical neck and surrounding the bone of the whole upper arm. At the flexor side of the elbow joint this new bone ended sharply with jagged edges projecting into the soft tissue; on the extensor side the new bone formation extended beyond the olecranon surrounding a fracture in the upper part of the ulna and ending in a projection reaching over the radius. The ends of the fracture in the upper arm were not rejoined by bone, but seemed to have been resorbed to a considerable degree. The upper arm owed its rigidity to the newly formed bone masses which had a web-like structure. Most of the muscles of the upper arm were replaced by the bony structure. It is assumed that an extensive effusion of blood occurred with rupture and displacement of periosteum, resulting in the extensive ossification.

Polgár, Franz. The roentgen picture and clinical significance of genuine duodenal diverticulum. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1927, xxxv, 1220–1230.

Two types are to be distinguished: (*a*) the genuine, and (*b*) the pseudodiverticulum of the duodenum. Only in exceptional cases is the distinction between the two difficult. The diagnosis never requires the taking of a roentgenogram; roentgenoscopy in various directions, especially with the patient lying on the side, and employment of bimanual pressure on the gastric contents suffices to bring out the characteristic roentgen symptoms, which are as follows: (1) Round or half-moon shaped contrast shadow close to the course of the duodenum, i.e., in paraduodenal position. The size and shape of this spot may change during filling, the upper boundary usually lies horizontally and above it; one may detect an air bubble and often also a layer of fluid; in other words, the well-known three-layered filling picture. This barium depot is most usually found within the duodenal ring. (2) Apart from the filled diverticulum, the duodenum shows no disturbances of passage, that is, symptoms of stenosis are absent. (3) The isolated shadow is connected with the lumen of the duodenum by a long or a short channel. The width of this channel varies from 1 or 2 mm. up to 2 or 3 cm. It is visible usually only for a short time during the contrast meal examination, that is, during the phase of filling and of emptying. (4) The contours of the diverticulum shadow are sharp, rounded, and Kerkring's folds of the small intestine are absent in it. However, the narrow connecting channel may often present small folds of mucosa. (5) After the emptying of the gastroduodenal section, the contrast material in the diverticulum may be retained and thus appear as an isolated barium shadow. This symptom does not always occur. It has been found in about one-third of the cases. This retention may last for hours or days. The time of emptying may be dependent on the position in which the patient is lying.

The demonstration of retention in a diverticulum is of definite clinical importance. The authors observed a series of 17 cases in 5 of which duplicate diverticula were detected. In the whole series there was only one case of diverticulum of the pars horizontalis superior. The author objects to the explanation that these diverticula are of congenital nature since they develop usually in adults. It is suggested that one should regard diseases capable of causing increase in intra-intestinal pressure (intestinal catarrh, appendicitis, gastric and duodenal ulcer, etc.) as the underlying cause for the condition.

The finding of diverticulum is very frequently only an incidental observation and it should be regarded as a sign to search for other abdominal disease. In 2 cases both peptic ulcer and genuine duodenal diverticulum were present; one of the cases showed the simultaneous existence of two ulcers and two diverticula.

Romang, F. The roentgen diagnosis of cholelithiasis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1927, xxxv, 1199–1220.

Pure cholesterol stones may, in especially favorable cases, reveal themselves as negative shadows. Pure bilirubin stones are not detectable roentgenographically. Gallstones of mixed composition are demonstrable only in proportion to their content of inorganic calcium. Statistical experience shows that in 50 per cent of patients with numerous facetted gallstones of mixed composition, the direct roentgenological detection of such stones and consequently the definite diagnosis of cholelithiasis is successful. In 60 per cent of those cases having one or a few cylindrical or barrel-shaped gallstones of mixed composition, a definite diagnosis of cholelithiasis can be successfully made by direct roentgen visualization.

In every case showing positive gallstones roentgenographically a concurrent examination must also be made of the gastrointestinal canal with the aid of contrast meal because occasionally the stone or stones represent an incidental finding, and the primary disease may be an ulcer or neoplasm in the stomach. The roentgen examination confirms experience that the content of inorganic calcium indicates an inflammatory origin of the process or at least inflammation as a contributory factor. Incidentally, a positive roentgen finding of gallstones furnishes data regarding the number, location, shape and hints as to the composition of the stones, data which are of considerable value in the event that an operation is necessary.

Certain indirect symptoms may give valuable indications for a diagnosis of gall-bladder disease. Those of special importance in this connection are indentations of the bulbus produced by the gall-bladder, the existence of a megabulbus, distortions and displacement of the duodenum, the stomach and the hepatic flexure, and also possible spastic phenomena of the whole gastrointestinal tract. A sharply localized pressure point is a valuable detail to be considered in differential diagnosis. These indirect symptoms are individually nonspecific, but the more of them present, the more certain is the diagnosis. Taken in connection with a successful demonstration of gallstones, they enable the clinician to draw important conclusions regarding the character of the cholelithiasis present. In order to eliminate inaccurate diagnoses, all the various possibilities in the interpretation of the individual symptoms must be kept in mind. In 40 per cent of the cases observed by the author, the above indirect symptoms alone or combined were demonstrable; in only 2 of the cases the gall-bladder at operation was found without sign of disease.

Cholecystography is a valuable diagnostic aid in the diagnosis of gall-bladder disease. The most reliable method is the introduction of the contrast material by intravenous injection. The introduction of the dye orally, duodenally or rectally involves uncertainties as to the complete absorption of the contrast material. This uncertainty is too great to permit valid conclusions to be drawn from the subsequent examination. By contrast filling of the gall-bladder, cholesterol stones which ordinarily escape roentgen detection may become visualized. The method also permits determination of disturbances in the shape and function of the gall-bladder and its efferent duct. Both the negative and positive finding by this method justifies fairly reliable diagnostic conclusions. A number of illustrative cases are cited and a bibliography of 41 references is appended.

Rubin, I. C. Diagnostic use of intra-uterine iodized oil injection combined with the *x*-rays, as compared to peruterine CO_2 insufflation. *Radiology*, August, 1928, xi, 115–125.

In a study of 66 cases, it was found that the results of examination were the same with iodized oil injection and peruterine CO_2 insufflation in 60 cases and in the other 6 cases the differences were only slight. One of the most serious objections to the use of iodized oil for this purpose is the possible harm, especially by inducing pelvic abscesses and peritoneal irritation. The other method, however, does not have these objections and gives the results

desired without attendant danger. The principal value of lipiodol is the aid it offers in obtaining roentgenograms of obstruction in the tubes and of distinguishing submucous myomata of the uterus. On the other hand, CO_2 insufflation demonstrates tubal patency as well as nonpatency and the gas is readily absorbed and leaves no trace in the peritoneal cavity. It is simpler to carry out and less troublesome to the patient. Its diagnostic value as compared to lipiodol is equal in the study of tubal closures. It is superior to lipiodol in demonstrating tubal spasm, which can be recorded graphically by means of the kymograph, and impaired function of the tubes can be shown in the same way.

Sante, L. R. Pneumothorax. Radiological study. *Radiology*, August, 1928, xi, 126–133.

Pneumothorax is caused by gas gaining entrance to the pleural cavity by means of an opening in the chest wall or diaphragm or from within by rupture of the lung from a variety of causes. Tuberculosis is the most common disease which causes pneumothorax, but operative procedures, such as rib section for empyema, artificial pneumothorax for therapeutic purposes, cause the greatest number of cases. Spontaneous pneumothorax may also occur as a complication of pleural effusions, and also from aspiration or attempted aspiration. Roentgen examination of the chest in various positions is a great aid in establishing the true nature of the condition.

Solomon, I., and Gibert, P. Chrondromatosis of the joints. *J. de radiol. et d'électrol.*, June, 1928, xii, 275–279.

A young woman came for treatment in January, 1924, for swelling of the knee joint from which she had suffered since 1919; various treatments had been ineffective. Movement of the joint caused only slight pain; flexion of more than 90° was possible. Roentgen examination showed a large number of foreign bodies in the interarticular space. The authors made a diagnosis of arthritis and gave roentgen treatment which overcame the swelling and greatly improved the functional condition but did not affect the foreign bodies. After two and a half years the swelling recurred and the patient complained that the foreign bodies interfered with walking. They were removed surgically and were found to be made up of fibrocartilaginous tissue which had undergone partial calcification; they did not show any trace of malignancy.

Panner has collected 50 cases of this form of articular chondromatosis, 19 of them published by Jones of the Mayo Clinic. It is characterized by the presence of many small tumors originating from the synovia and finally becoming free in the joint cavity. The development of the disease is very slow and almost always only one joint is involved. The chief symptoms are pain and interference with movement. The treatment is surgical removal of the foreign bodies.

Staunig, Konrad. The fracture-suspicious, post-traumatic arthritic attack. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1927, xxxv, 1252–1255.

There is a group of cases presenting the following history: After a relatively mild trauma following a definite latent period of several days to weeks, there occurs an attack with inflammatory symptoms in the injured joint. The basis of this attack is an arthritic condition, but the case is usually referred to the roentgenologist as one of suspected fracture.

The roentgenographic signs are those of arthritis deformans, showing the typical changes both in the shape of the bone and its structure. The changes vary in magnitude. The structural changes observable are: more or less fading of the bony structure; not infrequently there occurs an opaque, homogeneous appearance of the region of the metaphysis and epiphysis; the bone presents a mottled appearance. At the same time, there is no loss in density of the bone, there is no decalcification. The change in shape of the bones in arthritis is greater the longer the duration of the disease. The deformities involve mainly the portions of bone near the joint cartilage, producing at the bone-cartilage boundary variously shaped ridges and protuberances. Five illustrative cases are briefly cited.

The method of choice in the treatment of these conditions is roentgen therapy. The more the inflammatory symptoms are present, the more certain and rapid are the effects of roentgen treatment. The details of the treatment are not given.

Vincent, C., Thoyer-Rozat, Cossat, P. and David, M. Ventriculography with air in eight cases of tumor of the brain. *J. de radiol. et d'électrol.*, May, 1928, xii, 209–216.

Eight cases of ventriculography with air in tumor of the brain are described and illustrated by roentgen plates; 4 were frontal tumor, 2 temporal, one occipital and one cerebellar. In 7 of the cases the examination gave an accurate localization; in one case a mistake was made but the authors think possibly this might have been avoided by more careful

interpretation. Among the cases localized accurately by ventriculography there had been accurate clinical localizing signs in only 2, which shows the great value of the method. But it is not entirely without danger. Among 16 cases of insufflation most of the patients had headache, sometimes accompanied by vomiting and bradycardia. In 3 cases there was a brief loss of consciousness during the insufflation but these patients had had such attacks before. In one case after a second insufflation there was a puriform meningeal reaction for forty-eight hours. In one case there was death six hours after the insufflation. This could have been avoided if a decompressive operation had been performed before the insufflation. And at any rate patients with tumor of the brain are in constant danger of death even without ventriculography, and the method is justifiable even if it were more dangerous as the mortality without operation is 100 per cent. Four of the patients were operated on, thanks to the localization made by the ventriculography, and one of them is still well. The interpretation of the pictures is sometimes difficult.

Wallace, W. H. The diagnosis of early infections in the pleural cavity, especially in the lungs. *Radiology*, May, 1928, x, 425–430.

The author gives a general review of the usefulness of roentgenograms of the chest in diagnosing early infections in the pleural cavity. By using care in the making of the films and equal care in studying them, correct diagnosis is possible in a surprising number of instances. However, the author stresses the necessity for careful study of the roentgenograms and a thorough understanding of what the normal should be.

Watkins, W. Warner, and Mills, Harlan P. Routine cholecystography. *Radiology*, August, 1928, xi, 91–98.

It is concluded as a result of routine cholecystography of 625 cases that the use of the oral route is valuable from the standpoint of its convenience, accessibility to the roentgenologist and should be used in the routine examination of gastrointestinal patients. One-half the patients referred for gastrointestinal examination show evidence of a functionally disabled gall-bladder. It is shown further that this method for examination of the gall-bladder is as accurate as any in the domain of roentgenology. The diseased gall-bladder, however, may continue to function normally and 30 per cent of patients proven at operation to have cholecystitis showed normal function by the Graham dye test.

Wesson, Miley B. Urography—common diagnostic errors. *Radiology*, May, 1928, x, 431–437.

Syringe injections in urography are responsible, in part, for many diagnostic errors. In spite of great care, it is hardly possible not to over-inject. A better plan is to inject by means of 50 c.c. burettes held at an elevation of 18 to 24 inches, which is amply sufficient to fill the pelves without pain to the patient. After from 4 to 10 c.c. has slowly run in, the column remains stationary, showing that the pelves are filled. Double pyelograms should always be made unless there are specific contraindications, the principal one being marked impairment of kidney function. Double pyelograms allow the roentgenologist and urologist to make comparisons of the two sides, and is also less expensive for the patient. The use of 12 per cent sodium iodide is harmless and should be used generally for this purpose.

Six cases are reported with roentgenograms to illustrate them, in which diagnostic errors were made. In one a filling defect in a normal kidney was diagnosed as malignant, but was due to a stiff No. 8 Garceau catheter and syringe pressure. In another there was retroperitoneal extravasation of sodium iodide at the level of the stone following ureterogram. Stones which appeared to be in the bladder were found in the prostrate. Other diagnostic errors were given in the remaining cases which could be avoided.

ROENTGEN AND RADIUM THERAPY

Binkley, George E. Treatment of rectal cancer. *Radiology*, June, 1928, x, 457–467.

The majority of rectal tumors respond to efficient radiation, a small percentage disappearing after relatively small doses, while a few are decidedly radioresistant. Early recognition and careful classification are of most importance, and the classification should include the location of the growth, degree of malignancy, local extension and distant involvement and radiosensitivity of the tumor cells. When radium is employed, gold seeds are to be preferred. In certain cases a combination of radium and surgery is the method of choice. Radium is to be preferred to high voltage roentgen radiation. Over-dosage with radium results in necrosis and sloughing, while inadequate doses result in palliation but not eradication of the tumor. Accurate distribution and proper dosage are essential for best results. In radiosensitive tumors, external irradiation

alone will be sufficient, and external irradiation is advisable in all cases, even when radium is used later. This treatment includes irradiation of two anterior and two posterior portals of the pelvis, an erythema or suberythema dose being given at each portal. Four case reports are given, in one of which a routine pelvic cycle of high voltage roentgen-ray was sufficient, with colostomy, to effect cure. In the other three the implantation of radium was added to colostomy and external irradiation. In two of these cases gold seeds were used with good results and in the other emanation seeds with marked palliation.

Dautwitz, Fritz. External irradiation with radioactive substances. *Strablentherapie*, 1927, xxvi, 45–64.

The author presents a general review of the subject followed by an extensive bibliography. There is appended a table in which is given the various conditions, external and internal, together with the reported form of radium therapy and a statement of the results. The original must be consulted for details.

Doub, Howard P. Radiation reactions and their treatment. *Ann. Clin. Med.*, 1927, v, 715–719.

The symptoms vary from a mild discomfort, with lack of appetite, to violent systemic reactions manifested by nausea, salivation, vomiting, and sometimes by chills and fever. The mild reaction ordinarily requires no medical treatment of any kind and is only a slight discomfort to the patient. In the patients with more marked symptoms which usually begin an hour following irradiation, there is considerable nausea, with usually one attack of vomiting; the reaction beginning within an hour after irradiation. In another class of patients, symptoms may come on even sooner and consist of violent nausea and frequent attacks of vomiting (some as often as every fifteen minutes). In still another group, the acute symptoms are not so marked but the constitutional reaction tends to run a chronic course with a long-drawn out convalescence. These patients have an aversion for food and have difficulty in eating.

There is, in addition, a class of patients who have been overirradiated and show definite radiation cachexia. This condition is ordinarily brought on by overirradiation of the abdominal organs or lymphatic system. It would seem that the area of the body treated determines to a large extent the frequency and severity of of a reaction. Experimental investigation seems to indicate that the acute illness coming on after irradiation is due to the products of nuclear destruction which act as strong bases causing an alkalosis and acting like monovalent salts on all the cells of the body. An investigation was made of some of the agents which have been advocated to combat radiation sickness, and to determine their effect on the chemical and on the clinical reaction. Very little or no effect was noted with hydrochloric acid, ammonium chloride and sodium chloride. Morphine sulphate administered one hour before irradiation prevented the immediate radiation sickness in most instances, and lessened it in others. Calcium lactate and calcium chloride administered either orally or intravenously appeared to exert a beneficial effect on the symptoms of both patients and animals, although it did not prevent or alleviate the illness in all cases. It appears that these agents help to maintain the normal level of the metabolic processes in spite of the irradiation.

There are two phases to the medical management of deep roentgen-ray therapy. First, the pre-irradiation period in which the patient should be gotten into proper condition, and second, the post-irradiation period, that of treating the various symptoms arising after irradiation. The patient should be prepared in the same manner as if he were to undergo a major surgical operation. If advanced anemia and toxemia are present a blood transfusion should be performed. The advanced case should receive treatment in the form of fractional doses rather than single massive doses. This type of patient should always be hospitalized.

Following heavy irradiation, every effort should be made to stimulate the eliminatory processes of the body so as to lessen the constitutional effect of the toxic products of cellular destruction. The diet should be planned to sustain the patient's weight and strength. It has seemed advisable to eliminate meat from the diet to a large extent during this period. The use of cod liver oil has been found beneficial. The bowels should be kept in order, and liquid petrolatum is sufficient for this purpose usually. Heavy irradiation over the abdomen and pelvis is sometimes followed by distressing symptoms, characterized by marked and persistent diarrhea, the passage of much mucus, sometimes mixed with blood; rectal tenesmus may be present; frequent and painful urination are met with in injury to the bladder mucosa. Enteritis and proctitis require considerable time for relief. The acute reaction immediately after treatment, manifested by nausea and vomiting, yields in many cases to the use of calcium lactate. Many patients feel better if they are on a fluid diet during this period.

To avoid the possibility of skin reactions,

the patient should be warned not to use excessive heat, adhesive plaster, alcohol, phenol, salicylic acid and like irritants, since the effects of these added to those of the roentgen rays are almost certain to produce an excessive reaction.

Eller, Joseph J., and Bucky, Gustav. The use of the "grenz" (infra-roentgen) rays in dermatologic conditions. *Arch. Dermat. & Syph.*, Feb., 1928, xvii, 221–238.

The "grenz" rays are those of wave length intermediate between roentgen and ultraviolet rays. As the names of the different parts of the spectrum do not refer to the biologic action, it was difficult to state specifically whether these were roentgen rays or ultraviolet rays. Therefore, the name "grenz" (which means borderline) was given to this class of radiation. The name refers only to the biologic actions, which merge into those of roentgen rays and the ultraviolet. The synonym infra-roentgen rays has been adopted as a terminology applicable to the physical properties of the rays. The penetration of these rays is small; 2 mm. of water will absorb more than 90 per cent of the beam. The grenz-ray beam has its maximum at from 1.9 to 2.0 Å, only about 10 per cent of the radiation lies between 1.6 and 1.7 Å. To produce this radiation, a special apparatus is necessary for operating at low voltage ranging between 5 and 9 kv.; equivalent to spark gap of 1.06 to 1.9 mm. between spheres 2 cm. in diameter. The roentgen tube is of the heated filament type.

The standard of dosage adopted by the authors as a means of measurement has been obtained arbitrarily, but seems to have worked out in a satisfactory manner. One unit is considered that dose necessary to produce a mild erythema between twelve and twenty-four hours after exposure. The redness from this dose subsides in about ten days, and it was found that this dose could be repeated safely every two weeks several times. Most of the conditions treated have required 2 unit doses to produce results. As yet, epilation has not been observed from repeated doses of 2 units each. Apparently this amount can be administered every three or four weeks without detrimental effect. The grenz rays in this dose usually caused a rapid change in the lesions, had more or less of a drying effect, with scaling and crusting in the larger doses and always caused a marked pigmentation. No signs of atrophy or telangiectases have been observed in patients treated over a year ago with blistering doses of the grenz rays. The largest area that can be exposed at one time conveniently is about 4 in. in diameter. To cover this area the tube is placed so that the distance from the target to the skin is about 3½ in. For the treatment of an area the size of a half dollar, the tube is placed 1.2 to 2.0 in. from the skin.

For the past sixteen months the authors have had under observation 87 patients treated with these rays. Twenty-seven different skin diseases are represented in this group. Acne vulgaris was one of the conditions that responded favorably. These patients received generalized exposures and all of them improved greatly without being treated locally. A case of acne keloid has been improved considerably. In 3 cases of cavernous angioma the tumor decreased in size and color. The response, however, has been slow. Five patients with dermatophytosis have been treated and 4 were cured rapidly, one discontinued treatment. Six patients with basal cell epithelioma were treated; in 5 who were cured there was excellent cosmetic effect. One had an epithelioma involving the entire right upper eyelid. After two bi-monthly treatments of 2 units each to the eyelid, the infiltration decreased considerably. At no time were there any untoward symptoms in the eyeball, although no extra precaution was used. Fifteen patients with various types of eczema were treated. All were cured, at least temporarily, with 1 unit dose each. In one case of herpes zoster, a 2 unit dose relieved pain almost immediately. Six patients with keloids were treated, but the lesions required large doses and responded slowly. In 6 cases of lupus erythematosus of the discoid type, the infiltration almost disappeared in five weeks after a 2 unit exposure, but there always remained small patches of active disease or rapid recurrence. One patient with hypertrophic lichen planus responded favorably after a few doses of 2 units each. In 2 cases of leucoplakia of the tongue, the patients were cured by two exposures to each lesion. Two patients with paronychia were cured.

The results in 2 cases of psoriasis were poor; the patches either did not respond to the treatment or when they did recurrences were rapid. Five cases of pruritus ani were all cured after receiving four ½ unit doses at ten day intervals; 3 cases of pruritus vulvæ responded similarly. The treatment was a complete failure in one case of scleroderma. One case of xanthelasma was treated without effect.

These preliminary results indicate a promising field for grenz-ray therapy. It is interesting that deep-seated lesions such as epitheliomas and sarcoids respond to this type of radiation, although the rays have slight penetrative power.

Furst, Walter. Treatment of malignant diseases of the female sexual organs. *Radiology*, August, 1928, xi, 141–152.

Roentgen-ray treatment as a preoperative procedure is preferable to the use of radium as a source of radiation. It is difficult to make use of radium in malignant diseases of the female sexual organs. The roentgen ray, on the other hand, covers a broader field and penetrates more deeply. The preliminary irradiation with radium before operation is considered inadvisable, but the use of the roentgen ray is not only helpful as a preoperative treatment, but often sufficient of itself in the treatment of these malignancies, such as, especially, carcinomata from embryonic cells. From a symptomatic point of view, nearly all carcinomata respond to appropriate roentgen treatment. Bleeding and infection either diminish or stop entirely, and frequently a clean ulcer will be found in place of a formerly infected tumor mass. There is an increase in hemoglobin, and the general power of resistance of the patient is increased. There is, at the same time, a decrease in the difficulties attending the performance of a major operation. During the days of rest which follow such irradiation, inflammatory changes of the parametrium grow milder, and frequently patients who were considered in the beginning to be inoperable can then be operated on. While irradiation does not free the field of operation of bacteria it does seem to weaken their power of penetration and lessens the chances of peritonitis. In a series of 47 cases, not a single case of peritonitis followed operation after preoperative irradiation.

Postoperative irradiation is not recommended by the author, except when examination has shown that cancerous tissue has been left behind or unless the whole vascular system of the local tissues has already been weakened, when large doses of roentgen ray are indicated. The author is definitely in favor of biopsy as an essential feature in diagnosis. After biopsy, irradiation is given immediately in the hope of destroying any cancerous cells which may have been torn loose and found their way into the lymphatic vessels. Case reports are given in which preoperative irradiation permitted results which could not have been hoped for if irradiation had not been performed.

Granger, Frank B. The advantage of combining methods of treatment in physical therapy. *Radiology*, March, 1928, x, 252–255.

Since the late war, physical therapy has been placed on a rational and scientific basis. It should be used only as an adjunct to the usual medical and surgical procedures, and usually the physical therapy will be applied with two or more other treatments. It has been shown that in many surgical conditions functional restoration is dependent on physical therapy and in many pathological conditions results are obtained which would not be secured without this treatment. The author further stresses the need for continued teamwork with the other branches of medicine.

Guy, W. H. *X*-ray therapy in non-malignant skin lesions. *Radiology*, June, 1928, x, 453–456.

The roentgen ray, when properly used, is the most valuable of the many physiotherapeutic agents which have been used in dermatology. The author gives a list of the diseases which are amenable to irradiation and after the name of each disease the skin doses recommended for each are given. Dosage of ¼ unit is usually repeated at weekly intervals, ½ unit at 10-day intervals and 1 to 4 units not under one month or until all reactive phenomena disappear. Proper diagnosis is prerequisite to good results.

Halberstaedter, L. Intracorporal radium treatment. *Strahlentherapie*, 1927, xxvi, 20–44.

In the employment of radioactive substances inserted internally in the body, the following aspects should be taken into consideration: (1) the nature of the radioactive material; (2) the nature of the radiations produced, and (3) the duration of application. As to the nature of the substances, there are two classes: (1) those of long life, whose activity may be regarded as practically unchanged during a treatment, namely, radium and mesothorium, and (2) those with a relatively short life, namely, radon, thorium *x* and actinium *x*. Radiothorium occupies a middle position. As to the nature of the radiation produced, pure or predominantly gamma radiation is obtained by the use of heavy metal filters of suitable thickness. Gamma plus beta radiations are obtained by lighter filtration. Predominance of beta plus alpha radiation is obtained by elimination of filtration, the practical source for this type being the shorter lived radioactive substances. From the standpoint of duration of internal treatment, two aspects are to be considered: (1) Where the radioactive material is to be applied only temporarily, the radiator being removed after a certain interval. For this purpose beta and gamma rays are used from either the long lived or the short lived radiators. (2) For permanent insertion, the short lived radiators yielding alpha, beta or gamma rays or in combination

may be employed in the form of solutions, suspensions, salves, powders, injected or introduced in capillaries of glass and metal, filtered or unfiltered.

In this general review of the subject, the author discusses the development of the method of intracorporal radium treatment, the biological reaction as observed in mammary carcinoma, in the rat testicle and in the rabbit skin, and the clinical results reported from the intratumoral treatment of carcinoma in various localities in the body. Special emphasis is placed upon the features of treatment with thorium *x* rods and needles as developed by Halberstaedter. A new field for the application of intracorporal radium treatment is in the handling of fistulæ of various kinds. The technique is simple. A thorium *x* rod as long as the fistula is introduced, care being taken that fragments do not escape and stick to the outside skin since a pronounced reaction would occur. Most fistulæ of various origins have been found to heal rather quickly. The only type which seemed to be refractory to this treatment was the intestinal fistula.

James, W. D., and James, A. W. Deep roentgen ray, radium myomectomy and hysterectomy. *J. Am. M. Ass.*, Jan. 21, 1928, xc, 201–203.

Myomectomy should always be the method of choice in a woman within the child-bearing age, provided there are no complicating conditions such as extreme anemia, excessive pelvic inflammatory disease, particularly pelvic abscesses. When the tumor is larger than 15 cm. in diameter, the difficulties of closing the wounds made by the removal of the large tumor may be so great as to make a hysteromyomectomy the preferable procedure. The type of uterine fibromyoma which can be treated most satisfactorily by radium and deep roentgen-ray therapy comprises the largest number of all. The following conditions, however, contraindicate the employment of radiation therapy: (1) Pedunculated tumors; (2) tumors associated with large ovarian cysts or acute pathologic conditions of the pelvis; (3) submucous tumors, especially those with pedicles; (4) degeneration in myoma or fibromyoma; (5) fibromyomas in a patient within the child-bearing period who desires children. All cases which do not fall in the above group may properly be treated by radiation. Women who are not good surgical risks belong to this group. The economic factor of hospitalization of patients away from their home duties is another factor which recommends the use of radium and deep roentgen rays. The detention of the patient in the hospital is reduced to a few days, as compared with several weeks incident to hospitalization and convalescence from operation.

Jamieson, Robert C. Irradiation of the thymus gland in the treatment of psoriasis. *Arch. Dermat. & Syph.*, July, 1928, xviii, 109–118.

For the treatment of some cases of psoriasis, irradiation of the thymus gland is apparently of benefit and has not shown any harmful results. In the cases observed by the author, it seems to be of most benefit in lessening the severity of the recurrences in many inveterate cases. The factors employed in treatment were kept as nearly constant as possible and the same apparatus was employed throughout: 88 kv. (6 in. spark gap), 5 ma., skin target distance 12 in., 3 mm. Al. The time of exposure was varied to meet the amount of dosage required. The area irradiated extended from the laryngoclavicular line to the fifth intercostal space, with the parasternal lines as lateral boundaries.

Of the 50 patients treated by this method, 32 were males and 18 females, the ages varying from six to sixty-two years, with an average of thirty-two. The lesions had been present for two months to forty years and were of all types and all grades of severity. None of the patients showed a rapid change in condition but there were 2 who could be called cured, as judged by the complete disappearance of the lesions which have not recurred. Those cases in which the lesions were small, scattered and few, were resistant to treatment. The patients who were considered definitely improved (5 or 10 per cent) were of different physical types, but all had the same general type of lesion: widespread, profuse and of long standing.

Among the patients considered temporarily improved, there was no uniformity of physical type which showed more improvement than others. Seventeen of the cases (34 per cent) showed temporary improvement; in many of these it was transitory and in some of considerable duration. Twenty-eight patients (56 per cent) were considered unimproved. The author suggests that possibly his failures to secure as high a percentage of good results as reported by Forster may have been due to the use of a less penetrating radiation.

Jones, T. E. Treatment of carcinoma of rectum by radium. *Ann. Int. Med.*, 1927, i, 13–16.

Although it is felt at the present time that whenever possible the best treatment for cancer of the rectum is some type of radical opera-

tion, there are two classes of patients who must be offered some alternative treatment: (1) those in an inoperable condition, and (2) those who refuse the radical operation. Radium has been used in these cases, and the author summarizes the results obtained in 65 cases. In the treatment, a colostomy is advised preliminary to the radium treatment; the incision being made large enough to permit an exploration for determining the condition of the liver, the mesenteric glands and the peritoneum in the floor of the pelvis. If these are grossly involved, the patient should not be subjected to treatment which will not benefit him. Colostomy greatly minimizes the discomfort of the patient during the period of the reaction to the radium treatment. After the colostomy, the distal segment of the colon is irrigated daily with large quantities of water for cleanliness. The radium treatment is given about seven days after the colostomy has begun to function satisfactorily. The technique of application of radium differs somewhat with the nature of the lesion. If it is papillary, needles or emanation tubes may be placed throughout the growth. If there is a flat ulceration an oval flat applicator is used. If there is a narrow constriction, tubes are placed tandem in the lumen of the bowel. It is essential that the radium be placed accurately in proximity to the growth, and the procedure should be carried out under sacral anesthesia without moving the patient from bed.

The dosage varies with the size of the growth. In the present series, the dosage varied between 2000 and 3000 mg-hr., the average being 2,600 mg-hr. Two treatments were generally given about three hours apart. The radiations are filtered through 1.5 mm. brass and 3 mm. rubber. When the radium reaction has subsided the patients receive external roentgen treatment. Experience indicates that further irradiation after the initial course is of little value. If recurrence takes place, it is treated by the implantation of a few seeds, but a large amount of radium is not needed and should not be used, since it is quite apt to cause excessive pain. If after one and a half or two years there is no evidence of disease and the bowel is not constricted, then if the patient insists, the colostomy may be closed.

The chief important complication of the radium treatment is pain, and a bearing-down sensation. This seems to be due to the inflammatory reaction in the mucosa. The author therefore protects as much as possible the healthy mucosa by the insertion of a lead screen 2 mm. thick. Another complication often occurring is hemorrhoids due to thrombosis in the hemorrhoidal veins and the ensuing congestion lower down. If metastasis in the pelvic glands appears, deep roentgen treatment may be tried, but radium is not advised. Extension into the liver occurs frequently, and occasionally into the lungs.

In the present series of 65 cases of carcinoma of the rectum, a colostomy was performed in 53; the other 12 patients refused to have a colostomy and all but one of these are dead. About two-thirds of the cases occurred in men. The duration of symptoms varied from one to thirty-six months. A mistaken diagnosis frequently of hemorrhoids was usually the cause of this delay. It is felt that these mistaken diagnoses are usually to be attributed to the custom of making a diagnosis without a digital examination. Fifty-seven of the cases in this group were inoperable. Of the 8 operable cases, 6 patients are living. The duration of life has been from two to four years. Of the 57 inoperable cases, 8 are alive, the duration of life being from two to four years. One case is reported briefly.

Kahn, Max. *X*-ray treatment of bone tumors, with special reference to tumors of unconfirmed diagnosis. *Radiology*, July, 1928, xi, 78–82.

The author reports very successful use of deep roentgenotherapy in cases of bone tumors of unconfirmed diagnosis. Three cases in which it was successfully used are cited. In one the left scapula and upper humerus were involved, the scapula showing extensive destruction and the head of the humerus being dislocated upward. A course of deep roentgen-ray treatments covering a period of seven months brought about clinical cure, and the patient became able to take up gainful occupation. Another case was that of a young man who had suffered trauma of the left thigh which was followed by a bone tumor. A course of deep roentgen-ray treatment extending for ten weeks resulted in new bone formation being largely absorbed and at the site of the tumor smooth, dense bone instead, suggesting a healed condition, and clinical cure. In the third case, there was destruction of the left frontal bone and left greater wing of the sphenoid, following amputation of the lower third of the femur three years previously. Deep roentgen treatment over a period of ten months, together with treatments with colloidal lead, brought about recalcification and a reduction of the bulging over the site of new growth. There was marked clinical improvement and the patient was able to walk with the aid of an artificial leg.

Luzes, F. F. Physiotherapeutic treatment of infantile spinal poliomyelitis. *J. de radiol. et d'électrol.*, April, 1928, xii, 172–177.

The author first irradiates the segment of the spinal cord corresponding to the injured limb or limbs following the technique of H. Bordier, with the object of destroying the connective tissue which forms around the diseased motor cells and destroys them. Roentgen therapy is particularly useful at this stage of connective tissue invasion and less so at a later stage which is chiefly destructive. But even in the second stage it is useful as the cells at different points in the cord are in different stages of the process and some of them may be saved. In the thirty days between the two series of roentgen treatments diathermia is used by Bordier's technique for the double purpose of supplying heat and overcoming the vessel spasm which prevents an adequate blood supply. The author finds diathermia much more effective than other methods of applying heat. Immediately after the diathermia he uses electrical treatment, not in a routine fashion but based on the indications furnished by electrodiagnosis. The electrical treatment should be given daily and as early as possible. This treatment is associated with massage, using stimulant movements for atrophied muscles and quieting ones for contracted muscles. He also uses slow and progressively graduated mechanotherapy as soon as the patient is able to use the muscles voluntarily. This treatment is more effective the earlier it is begun and the younger the patient.

MacKee, George M. Cutaneous roentgen-ray and radium therapy. *J. Am. M. Ass.*, Jan. 7, 1928, xc, 28–31.

The Council of Physical Therapy of the American Medical Association is sponsoring a series of articles setting forth the known merits and limitations of physical therapy. When completed, these articles will be published in book form. The present article deals with the use of radium and roentgen rays in the treatment of cutaneous conditions. Brief description is given of the apparatus necessary to produce hard, soft and supersoft rays; following this is a description of the technique of roentgen therapy, the erythema dose and the general therapeutic considerations. It is emphasized that the roentgen ray is the most valuable single therapeutic agent in the armamentarium of pure dermatology. However, both it and radium are dangerous modalities in unskilled hands. The physician who employs these agents should possess in addition to adequate equipment, a knowledge of their nature, biologic and therapeutic action, and of course, a thorough special training.

A brief description is given of the elements of radium therapy from the standpoint of equipment and technique. Following consideration of the matter of protection against these radiations, there is presented a section on therapeutic results in dermatology. The roentgen ray and radium, especially the former, have been found beneficial in more than 80 skin diseases. The author enumerates these dermatoses and indicates roughly the technique and the value of the treatment. The diseases are grouped approximately in accordance with the results obtained. The diseases are placed in thirteen groups.

Marin, A. Roentgen therapy of acne in America. *J. de radiol. et d'électrol.*, May, 1928, xii, 217–219.

The treatment recommended by MacKee and used by most physicians in America is a fractional treatment: 100 kv., distance from the anticathode to the skin 20 cm., radiation not filtered even in deep acne, dose 1 H per week. The patient lies on his back with his face turned toward the right shoulder and the tube is centered on the external third of the left zygomatic arch; the same thing is repeated on the opposite side of the face. Some dermatologists also give ½ H on the forehead and ½ on the chin. Most patients can take this weekly treatment for four months without a reaction; sixteen treatments or less are enough in about 60 per cent of the cases. If the acne is not completely cured by this time, it is best to let the skin rest for 4 or 5 months and then give four or five more treatments cautiously; some authors give up the treatment if sixteen applications do not cure. There is rarely any improvement before the seventh or eighth treatment; sometimes the acne even grows worse at first.

The treatment is not indicated in all forms of acne; it is very effective in indurated and deep acne and in papular and punctate acne. It is not advisable in superficial pustular acne. It is not indicated in acne rosacea which is not really an acne. MacKee treated 244 cases, with 95 per cent cures. The author has treated 19 cases, one of punctate acne cured in more than four months, 3 of papular acne, 2 of which were cured in less than four months and 15 of indurated acne, 9 of which were cured in two months and a half to four months. The skin should be carefully watched and if there is the slightest sign of atrophy, manifested by fine wrinkles, the treatment should be stopped.

Michael, Jeffrey C. Roentgen-ray treatment of acne vulgaris. *Arch. Dermat. & Syph.*, May, 1928, xvii, 604–618.

In a series of 246 patients treated with roentgen rays and adjunct therapy according to the method advocated by MacKee, no permanent untoward effect from the radiation was observed. Among the 191 patients in whom the end-result of treatment was determined, relapse occurred in 35 per cent after the first course of treatment. After a second short course, final success was obtained in approximately 85 per cent of all the cases. Of the factors affecting recurrence, the age of the patient seemed the most important. Among patients eighteen years of age or under, recurrence occurred in 44 per cent, and in those over twenty-five years old, there was recurrence in 7 per cent. Systemic disorders, such as constipation and other organic disturbances, seemed to increase moderately the number of recurrences. Focal infection appeared to play a decisive rôle in the failure to cure in some cases. The application of a few additional roentgen treatments after the disease was eradicated with a view of preventing the recurrence seemed to be valueless. Apparently the fewer the treatments required to cause disappearance of the disease, the less is the probability that a relapse will occur. A restricted carbohydrate diet appeared not to have any influence on the efficacy of treatment in the series as a whole, but dietary indiscretions in some patients seemed to precipitate recurrence. About 90 per cent of the recurrences took place within the first year after treatment.

The roentgen treatment employed in this series consisted of the application of ¼ skin unit unfiltered once a week. Every fourth dose was reduced to ⅛ of a unit, or omitted, and with few exceptions 16 weekly treatments (3½ units) were not exceeded. The factors of treatment were 2 ma., 6 in. spark gap (sharp point and voltmeter estimation), 8 in. focal skin distance, 40 sec. for ¼ unit dose. A broad focus Coolidge tube was used. In addition, the patients received dietary regulation and correction of obvious organic and functional disturbances, if present. Treatment was also given for constipation and menstrual disturbances. Local applications of medicinal nature were not permitted while the patient was under roentgen treatment.

New, Gordon B. Surgical procedures and radium in the treatment of cancer of the mouth and throat. *Surg., Gynec. & Obst.*, June, 1928, xlvi, 869–870.

What has been accomplished by radium in the treatment of cancer of the mouth and throat has been overshadowed by the number of inoperable cases that have increased at least 25 per cent as a result of its indiscriminate use in the treatment of the primary lesion and of nodes of the neck. The use of radium in the treatment of cancer of the mouth and throat is a very striking example of the misuse of a very valuable therapeutic agent. Before the advent of radium, the patient with a suspicious ulcer of the mouth or throat went to the surgeon who excised the lesion for microscopic diagnosis. If the lesion proved to be malignant, the gland-bearing fascia that drained the area were removed. If it proved to be benign, no further treatment was necessary. Today such lesions are frequently treated with radium by the radiologist, the dermatologist or the physician, with a small amount of radium at his disposal. Following this, one of two things may occur: the local lesion clears up entirely, only to recur in the lymph nodes of the neck later, or the local lesion becomes more active, and metastatic nodes appear in the neck.

Although radium has been used and is still being used in intrinsic cancer of the larynx, the end-results are not good and the sloughing of the cartilage which frequently follows is sometimes disastrous. Radium has a distinct place in the treatment of cancer of the mouth and throat, but it is being used at present in the treatment of many lesions for which it is doing more harm than good. Patients with rapidly growing, extensive cancers of the tongue and antrum, who could not possibly be benefited by any surgical procedures have been entirely cured of their trouble by radium. Radium seems to be of help in preoperative and postoperative treatment. It should not be used, however, to treat the questionable primary lesion, which should be excised for microscopic diagnosis, nor should it take the place of the removal of the gland-bearing fascia of the neck.

Nordentoft, J. Good Effects of roentgen treatment in a case of tumor of the hypophysis. *J. de radiol. et d'électrol.*, June, 1928, xii, 280–283.

A young girl of fifteen began to lose vision in her left eye in the middle of September, 1924. She grew rapidly worse and the progressive loss of vision was accompanied by intense headache. She was sent to the Rigshospital in Copenhagen where she remained from Oct. 25 to Dec. 13, 1924. A diagnosis of tumor of the region of the sella turcica was made and operation pronounced hopeless. She was given one roentgen treatment with irradiation of eight fields. She grew steadily worse, the right eye became involved also and

there was extreme exophthalmos of the left eye. When she was discharged her parents were told that she would probably die in a few days. She came to the author on Jan. 15, 1925. From that time up to April 8 she was given roentgen irradiation of eight fields. On discharge she was well in every way except that she was blind. The exophthalmos of the left eye had almost entirely receded. The author thinks that if the treatment had been begun earlier she might have been saved from blindness. In view of the rapid progress of the tumor and its sensitiveness to roentgen rays he thinks it was a malignant one. It has been two and a half years since the treatment and there is as yet no sign of recurrence.

Norris, Charles C. Radium in the treatment of gynecologic and obstetric conditions. *J. Am. M. Ass.*, Jan. 21, 1928, xc, 199–201.

At the Gynecologic Clinic of the hospital of the University of Pennsylvania there were 564 cases of benign uterine hemorrhage treated by irradiation. A single treatment cured 92 per cent of the cases. A second treatment cured 4 per cent more. Only 4 per cent subsequently required operation. The mortality from radiation treatment was 0.17 per cent. The average duration of hospitalization was 5.2 days. In this series, the source of radiation was radium. It was found that the radiation treatment, if it failed to check hemorrhage, did not militate against a subsequent operation.

There is no satisfactory method of treating carcinoma of the cervix. Among the five-year cases, the mortality varied from 50 to 90 per cent. There were 94 such cases treated by irradiation. The total five-year salvage was 13.8 per cent; pain was lessened or entirely relieved in 26.7 per cent; hemorrhage was lessened or entirely checked in 78.5 per cent; discharge was lessened or entirely checked in 70 per cent. Of early cases treated by cautery, amputation and irradiation 83 per cent remained alive. Of early cases treated by irradiation alone only 28.5 per cent remained alive. In the entire series complete local healing occurred in 60.7 per cent. The much better results obtained by cautery, amputation and irradiation is explained as due to the fact that removal of the cervix permits better orientation and more accurate application of radium.

The author has been treating cases of true ovarian insufficiency and of sterility by stimulative doses of screened radium. Fifty milligrams is introduced into the fundus and maintained in position by a stitch. The radium is left in place from two to six hours according to the age of the patient; 300 mg-hr. is the largest dose used. The author prefers to get less favorable results than to risk producing an amenorrhea. The total number of patients suffering from ovarian hyperplasia was 16. In 2 the dysmenorrhea was cured, in 10 it was lessened and in 4 there was no change. There were 5 cases of sterility due to ovarian hypofunction, in only one of which pregnancy resulted after treatment.

Portmann, U. V. Surgery and the *x*-ray in the treatment of carcinoma of the breast. *Radiology*, May, 1928, x, 377–382.

The use of roentgen therapy following operation for carcinoma of the breast very probably accounts for the greater success of surgical operation in the years since 1900 when postoperative irradiation was employed. It is further proved that intensive roentgen-ray therapy, especially by the cross-fire method, is not desirable, since there is a higher percentage of recurrences following such intensive treatment than following surgery alone. However, postoperative roentgen therapy by means of moderate repeated dosage decreases the number of recurrences and metastases and prolongs the lives of many patients.

Quigley, D. T. Some neglected points in the pathology of breast cancer; and treatment of breast cancer. *Radiology*, May, 1928, x, 383–388.

Cancer of the breast can be divided into three main groups: (1) carcinoma originating from papilloma growing on the lining of a cyst; (2) carcinoma originating in an adenoma; and (3) carcinoma originating from duct epithelium. Breast tumors in young women are usually benign, while in middle aged or old women they must be assumed to be malignant. Recurrence after operation is due to contamination with cancer-bearing lymph, or instruments, etc. It is theoretically possible to sterilize the area around the cancer and secondary gland cancers by preoperative treatment with radium as an intensive treatment to the tumor area, and the roentgen ray applied to a larger area as an extensive treatment. By taking this extra precaution, the number of first-year recurrences have been reduced from 75 per cent to about 25 per cent. Single local recurrences may be successfully treated with single radium treatments, while extensive recurrences are always fatal.

Roland, Marion M. Review of eighty cases of cancer of the breast. Incidence, location and prognosis. *Radiology*, May, 1928, x, 389–395.

As a result of treating 80 cases of cancer of

the breast, the author concludes that there is no successful curative treatment for advanced carcinoma of the breast, but when such cases can be brought to treatment early enough they can be cured by radiotherapy. However, the accuracy of diagnosis is not always certain. It is emphasized again that the chief hope for reduction of the cancer death rate lies in more thorough education of the physicians and of the laity in the early diagnosis and treatment of malignancies.

MISCELLANEOUS

Arnold, B. H., and Obriecht, A. M. Engineering the *x*-ray department. *Radiology*, June, 1928, x, 477–491.

The authors have submitted plans for roentgen-ray departments of varying sizes and for various purposes. Floor plans are given, with description and placement of apparatus. The requirements for ideal location and arrangements are outlined as well as suggestions for apparatus, etc., and the relation of these quarters to other parts of the hospital.

Behnken, Hermann, and Jaeger, Robert. The standardization of *x*-ray dosage. *Radiology*, April, 1928, x, 275–279.

It is suggested, first, that the early proposal of Villard would be the best standard for roentgen-ray dose measurement. However, the Solomon unit must be considered seriously, as well as the Fricke-Glasser method. The authors made a number of experiments with small ionization chambers in regard to their calibration with radium. They used a string electroscope with tubing to which the different chambers to be investigated could be connected. They succeeded in finding a small chamber which gave all the qualities required. It was made of bakelite 1 mm. thick and covered inside with a coating of magnesium and carbon powder of a suitable concentration. As a result of comparison with the Solomon method, the authors were able to word a definition of Solomon's unit as follows: "One roentgen is that *x*-ray dose which produces in a small ionization chamber of the Fricke-Glasser type (air-wall chamber), by eliminating the influence of the absorption and scattering of the walls, the same degree of ionization as is given during one second by the Gamma radiation of one gram of radium element at a distance of 1.33 cm. from axis to axis by filtering the radium rays through 0.5 mm. of platinum."

Burrows, Montrose T., Jorstad, Louis H., and Ernst, Edwin C. Further studies of the effect of graded doses of *x*-rays on animals fed on various dietaries, with a note on the effect of dietary in the treatment of patients with *x*-rays. *Radiology*, March, 1928, x, 209–216.

These observations show that roentgen rays act to cause molecular disintegration in the cell. When administered in small doses, the rays appear to stimulate, but when large doses are given there is more direct destruction of the fundamental structural elements of the cell. However, the resistance of the animal or patient may be raised considerably by the use of a well balanced diet rich in vitamine A. This fact has an important bearing in practice in that it may be possible by a proper dietary to protect the patient against those large doses of roentgen rays necessary in the treatment of cancer and other diseases, and prevent the defects of normal organs which often follow such treatment. By giving such a diet rich in vitamine A, it may be possible to continue treating patients which are otherwise refractory.

Carey, Eben J. Studies in the dynamics of histogenesis. XIII. The clinical application of the dynamics of histogenesis, regarding the origin, growth, and structural maintenance of patellar bone, knee joint, and related thigh muscles mobilization and the traction trabeculae and pressure pillars of human patellae. *Radiology*, March, 1928, x, 234–251.

Roentgenograms were used to study the inner structure of cross sections, cut serially, of the human patella, in a detailed study of the histogenesis of the patellar bone.

Chamberlain, W. Edward, and Newell, R. R. The epilation and the erythema dose. *Radiology*, April, 1928, x, 280–283.

The authors have shown that neither epilation nor skin erythema is satisfactory for defining roentgen-ray dosage with precision. There was no difference in epilation or erythema produced by equal doses in r-units or hard and soft roentgen rays. It is shown further that the maximum safe dose is several times the minimum erythema dose. In this study, they used roentgen rays of two qualities: (1) unfiltered, potential 100 kv., current 5 ma., coefficient of absorption in aluminum 4.28, and (2) filtered through 0.5 mm. copper plus 1.0 mm. aluminum, potential 190 kv., current 5 ma., coefficient of absorption in aluminum 0.598. The tests were made on the anterior surfaces of the thighs of five young men selected because of an abundance of black hair. Ten round areas were exposed on each thigh, the left thighs being treated with the unfiltered

beam and the right thighs with the filtered beam, doses on each thigh varying in 20 per cent steps from 1600 R down to 215 R.

Clark, George L. The *X*-ray diagnosis of chemical and industrial materials, and a new type of biological and medical diagnosis. *Radiology*, March, 1928, x, 185–198.

This represents a review of present chemical and industrial uses of the roentgen ray which have been classified as follows: (1) the spectrometric identification and wave length measurement of roentgen rays generated from various substances used as targets in roentgen-ray tubes; (2) the study of the direct chemical and electrical effects in inorganic materials; (3) the examination of materials for gross structure, imperfections, etc., and (4) the analysis of solids and liquids for fine structure. The discovery of new chemical elements has been made possible by use of the roentgen ray and it has been useful in many other phases of chemical research. The practical applications to industry have been many and varied, including examination of metal casting for gas cavities, sand, etc.; welds for soundness; classification of minerals; symmetry of gold balls; adhesion to cords in tires; insulated wire inspection; wood used in airplanes, for cracks, knots, etc., and many other uses. The study of crystalline structure has opened a new field for the roentgen ray and has made possible a mass of valuable information regarding the fine structure of many materials. Further information regarding bone structure, other calcareous structures, gelatin collagen, chitin, muscle fibers, hemoglobin, edistin, etc., have been of much value from a biological and medical viewpoint.

D'Istria, A. Apparatus for metrosalpingography. *Radiol. med.*, July, 1928, xv, 748–749.

The author describes and illustrates an apparatus to be used in roentgenography of the uterus and tubes. It consists essentially of a 20 c.c. syringe, a Recklinghausen tonometer and a metallic apparatus for the fixation and occlusion of the cervix of the uterus. The latter is the original part of the system. A metallic tube passes through it through which the lipiodol is injected into the uterus. With the cannula *in situ* firmly fixed to the uterus, the patient can be moved to the operating table or put in different positions for the taking of roentgenograms.

Friedrich, W. The physical foundations of radium therapy. *Strahlentherapie*, 1927, xxvi, 4–19.

A general discussion is presented in which it is shown that in radium therapy somewhat different physical conditions are involved from those in roentgen therapy. It is emphasized that in order to obtain successful application of radioactive rays for curative purposes, a thorough study of physical conditions is necessary, as much as of the clinical conditions. A description is given of the sources of the radiations, their nature and their measurements. The penetrability of the hard gamma rays of radium C and thorium C surpass by far the hardest roentgen rays in practical use. Half-value layers of 15 mm. of lead or 16 cm. of tissue have been measured. The measurement of gamma radiation for establishment of dose is of considerable importance. The difficulties in accurate measurement are considerable and require careful technique to be avoided. Measurements of dose distribution by the various proposed physico-technical procedures are not all in agreement. At any rate, they furnish a basis for the therapeutic use of radium preparations in a more or less reproducible manner. Various forms of radium applicators are described.

It would be of great interest and importance to obtain some connection between the radium dose and the standardized dose of roentgen therapy in terms of the R unit. In this connection, a good deal of work has still to be done. If it is assumed that a dose of hard filtered roentgen rays (about 1000 R, including recoil scattering) produces the same reaction on the skin as 560 mg-el-hr. at a distance of 1 cm. filtered through 1.5 mm. brass and 3 mm. celluloid to retain beta radiation, a uniform basis of dosimetry may be established. This particular value is obtained from the researches of Opitz and Friedrich. Where combined roentgen and radium therapy is employed, a uniform method of dose measurement is of exceedingly great importance. In radium therapy it may be necessary at times to take into consideration the secondary radiation produced, particularly by the heavy metal filters. To eliminate this factor, if it should prove of significance, it would be necessary to interpose a light metal filter like aluminum such as is done in roentgen therapy.